



**United States Department of the Interior
Bureau of Land Management**

September 2002



Battle Mountain Field Office
50 Bastain Road
Battle Mountain, Nevada
(775) 635-4000

PROGRAMMATIC ENVIRONMENTAL ASSESSMENT
Geothermal Leasing and Exploration
Shoshone-Eureka Planning Area

NV063-EA02-16

Table of Contents

CHAPTER 1.0 – INTRODUCTION/PURPOSE OF AND NEED FOR ACTION

Introduction

Purpose of and Need for Action

Land Use Plan Conformance Statement

Legal Mandates

CHAPTER 2.0 – PROPOSED ACTION AND ALTERNATIVES

Proposed Action

No Action Alternative

Alternatives Considered But Eliminated from Detailed Analysis

CHAPTER 3.0 – AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

Proposed Action

Mitigating Measures

Residual Impacts

Cumulative Impacts

CHAPTER 4.0 – CONTACTS AND COORDINATION

List of Preparers

Persons, Groups, or Agencies Contacted

Appendix A

Maps and Figures

Appendix B

Technical Report

GEOHERMAL EXPLORATION AND DEVELOPMENT PRACTICES

Appendix C

Impact of Geothermal Development on Water Resources

Appendix D

Executive Order 13212

Appendix E

Sample DNA

Appendix F

Seed Mixtures

APPENDIX G

Stipulations

APPENDIX H

Public Comment

CHAPTER 1.0 – INTRODUCTION/PURPOSE OF AND NEED FOR ACTION

Introduction

The earth is a giant reservoir of heat energy. Within the earth, at depths potentially accessible to drilling, are stored 10^{24} British thermal units (BTU) of heat. Most of this heat is too diffuse to be considered an economic resource. However, economical concentrations of geothermal energy do occur in localized “hot spots” where high temperatures are found in porous rocks containing liquid and / or steam. These “hot spots” are known as “geothermal reservoirs.” These “hot spots” are associated with recent volcanism and mountain building as well as in the deep part of many sedimentary basins.

One prominent “hot spot” within the Shoshone-Eureka Planning Area (Map 1) is known as the Battle Mountain High. Located in north-central Nevada, in parts of Elko, Eureka, Lander, Churchill, Pershing, and Humboldt Counties, it is an area of conspicuously high heat flow with an average heat flow of about three heat flow units¹ (HFU's) and thermal gradients which range from 30° to 60° C/km (2.6° to 4.3° F/100ft). Two HFU's are average for other parts of Nevada.

The energy in a geothermal reservoir consists of heat, largely stored in rocks, and to a lesser extent in liquid water and / or steam filling pores, fractures, joints, and faults. The water and steam provide a medium for the relatively rapid transport of heat from the reservoir rock to a depth shallow enough to be drilled. Water and steam also transfer heat directly to the surface via geysers, hot springs, mud pots, and fumaroles.

Due to the confining pressure in the reservoir, water is able to remain a liquid at high temperatures. As a reservoir is utilized, the hot water is brought to the surface where confining pressure is less. This decrease in pressure results in the formation of steam by boiling and a mixture of steam and water is produced at or near the surface. Most reservoirs contain either liquid water or liquid water with steam. A few reservoirs consist of only steam. Steam reservoir wells produce dry or superheated steam with no water. These dry system reservoirs are known to exist only in the Larderello-Mt. Amiata region of Italy and at The Geysers, California.

For a geothermal reservoir to have appreciable potential for exploitation, it must meet the following requirements:

- 1) Relatively high temperature (Greater than 250° to 400° F, depending on processing technology),
- 2) A depth shallow enough to permit drilling,
- 3) Sufficient rock permeability to allow the heat transfer agent (water and / or steam) to flow continuously at a high rate, and
- 4) Sufficient water recharge to maintain production over many years (20 to 50 years).

Geothermal resources have been used for generation of electric power, product processing, as well as space, agricultural, swimming pool, and spa heating. In addition, some geothermal fluids contain chemicals and metals that are potentially valuable byproducts.

¹ 1 calorie per square centimeter per second or 41.8 milliwatts per square meter.

About 4.3 million acres of 4.4 million acres in the Shoshone-Eureka Planning Area are open to fluid mineral leasing subject to standard lease terms and conditions.

Purpose of and Need for Action

The President of the United States has directed the Secretary of the Interior to reduce the delays in geothermal lease processing, Executive Order 133212 ([Appendix D](#)). In order to process new geothermal lease applications promptly and comply with the National Environmental Policy Act (NEPA) requirements, an updated programmatic geothermal environmental assessment (EA) needs to be completed.

The existing environmental assessments, “*Regional Environmental Analysis on Geothermal Leasing in the Shoshone Resource Area*” and “*Regional Environmental Analysis on Geothermal Leasing in the Eureka Resource Area*,” do not contain analysis of Cumulative Impacts or of the following critical elements:

1. Current Threatened, Endangered, and Special Status Species,
2. Invasive Nonnative Species,
3. Cultural Resources,
4. Native American Religious Concerns.

Because the existing EAs are inadequate, BLM is required to complete a new EA before the approval of each geothermal lease application.

This programmatic environmental assessment is to be used as the primary environmental document for the leasing of geothermal resources and the subsequent exploration in the Shoshone-Eureka Planning Area. This document will provide up-to-date analysis and mitigation measures not present in the existing environmental assessments.

Land Use Plan Conformance Statement

The proposed action is in conformance with the Shoshone-Eureka Resource Management Plan (RMP). Part II, Section E, MANAGEMENT ACTIONS NOT EXPRESSLY ADDRESSED BY THE RESOURCE MANAGEMENT PLAN, includes Minerals Objectives and Management Decisions brought forward unaltered from the Management Framework Plan. (Record of Decision p. 29) Minerals Objectives 1, 2, and 3, lead to Management Decisions 1 through 5 for locatable minerals, leasable minerals (geothermal steam), leasable minerals (sodium and potassium), etc. The objectives are:

- Objective 1:** Make available and encourage development of mineral resources to meet national, regional and local needs consistent with national objectives for an adequate supply of minerals.
- Objective 2:** Assure that mineral exploration, development and extraction are carried out in such a way as to minimize environmental and other resource damage and to provide, where legally possible, for the rehabilitation of lands.

Objective 3: Develop detailed mineral resource data in areas where different resources conflict so that informed decisions may be made that result in optimum use of the lands.

Management Decision #2, which specifically addresses geothermal steam, states: All areas designated by the BLM as prospectively valuable for geothermal steam would be open for exploration and development unless withdrawn or restricted from mineral entry. All public lands disposed of in these areas will have the geothermal resources reserved to the Federal government.

Legal Mandates

The Geothermal Steam Act of December 24, 1970, authorized the competitive and noncompetitive leasing of geothermal resources and associated byproducts in public lands.

The Geothermal Energy Research, Development, Demonstration Act of 1974 promotes the development and utilization of geothermal resources.

CHAPTER 2.0 – PROPOSED ACTION AND ALTERNATIVES

Proposed Action

The proposed action is the leasing and subsequent exploration of BLM-administered geothermal resources in the Shoshone-Eureka Planning Area, under provisions in a programmatic geothermal EA, subject to site-specific analysis, as needed. The proposed action does not include development of geothermal resources, nor does it include actions on privately owned lands within the Shoshone-Eureka Planning Area.

Having a Programmatic EA would provide a means of processing geothermal lease applications in a timely manner and thereby comply with the direction of the President's Executive Order 133212 ([Appendix D](#)) and the recommendations of the National Energy Development Group ([Appendix One](#), Page 10, Chapter 6, Recommendation 5).

Proposed Action (With Programmatic EA)

Action to be Analyzed	Minimum Required NEPA Analysis	Minimum Anticipated Time Frame
Lease Application	DNA ²	1 month
Exploration Permit	DNA (May lead to an EA)	1 month
Development	EA	12 months
Production	EA or EIS ³	18 months
Total Time Required		32 months

Table 1

The issuance of a lease conveys to the lessee the right to actively explore and / or develop the lease in accordance with regulations, lease terms and attached stipulations. A geothermal lease does not authorize surface-disturbing activity on public land.

The smallest lease land size is all lands available within a section. The largest lease, with occasional exceptions (see 43 CFR 3204.15), is 2,560 acres.

Subsequent lease operations, such as exploration and / or development, would require BLM authorization and, if necessary, environmental review. Subsequent lease operations must be conducted in accordance with regulations, Geothermal Resources Operational Orders, and any Conditions of Approval developed as a result of site-specific NEPA analysis. Any proposed surface-disturbing activity must undergo a site-specific NEPA analysis before authorization can be granted. Any surface-disturbing activity must receive written approval from the Authorized Officer (BLM Manual 3200-1 I).

For exploration activities, the operator must file an exploration application that identifies, among many things, the areas to be explored and the method of exploration. When the operator has filed this application with the local BLM office, the proposed action identified in the exploration application undergoes NEPA review to determine if there are any environmental conflicts in the

² Documentation of NEPA Adequacy

³ Environmental Impact Statement

area to be disturbed. The screening for environmental conflicts is accomplished, at a minimum, via a DNA (See Appendix E). If there are any environmental conflicts, the BLM may, at its discretion, disapprove the application or modify the application by requiring additional mitigating measures. Should the operator not be willing to accept the decision, the application can be modified and resubmitted, or the decision can be appealed.

In the Shoshone-Eureka Planning Area, restrictions in some areas may include timing limitations, controlled surface use, or no surface occupancy (NSO) stipulations used at the discretion of the Authorized Officer to protect identified resources of special concern.

Development of geothermal resources can be done only on approved leases. The development of a geothermal resource involves several major phases from exploration to actual development that must be approved separately. Each phase must undergo the appropriate level of NEPA compliance before it may be approved and authorization issued. Geothermal leasing and subsequent exploration will undergo a DNA to determine if additional, site-specific, NEPA analysis is required.

Geothermal exploration operations include, but are not limited to, geophysical operations, airborne exploration, off-road vehicular travel, trail construction, drilling temperature gradient wells, drilling holes used for explosive charges for seismic exploration, core drilling or any other drilling method (provided the well is not used for geothermal resource production), and rehabilitation. Exploration operations do not include the direct testing of geothermal resources or the production or utilization of geothermal resources. Appendix B outlines some specific exploration methods and some known possible related effects.

Operations and other development and production activities **not** covered in this environmental assessment include production well drilling, direct testing of the geothermal resources, chemical sampling of the geothermal resource, road construction, and improvement, production, maintenance of production facilities, waste disposal, construction camps, construction of electric transmission lines, and plant construction, development, and expansion. Appendix B gives a brief report on some development possibilities and outlines some known possible related effects.

No Action Alternative

Under this alternative, geothermal leasing and exploration would continue as at present and would be guided by the “*Regional Environmental Analysis on Geothermal Leasing in the Shoshone Resource Area*” and “*Regional Environmental Analysis on Geothermal Leasing in the Eureka Resource Area*.” There would be no change in the actual permitted action from that of the proposed action. This alternative has an adverse energy impact by not expediting the permitting process. Further, this alternative does not comply with the direction of the President (Executive Order 133212) and the recommendations of the National Energy Development Group (Appendix One, Page 10, Chapter 6, Recommendation 5).

**No Action Alternative
(Without Programmatic EA)**

Action to be Analyzed	Minimum Required NEPA Analysis	Minimum Anticipated Time Frame
Lease Application	EA	9 months
Exploration Permit	EA	12 months
Development	EA or EIS	12 months
Production	EA or EIS	18 months
Total Time Required		51 months

Table 2

Alternatives Considered But Eliminated from Detailed Analysis

Designating Geothermal Leasing and Exploration Areas: One alternative would be to limit geothermal leasing and exploration, and therefore subsequent development, to specific locations within the Planning Area. Due to the lack of research, surveys, and inventories necessary to designate areas for geothermal leasing and exploration within the 4.3 million acres of the Planning Area, and because it is inconsistent with the direction set forth in the Shoshone-Eureka Resource Area Management Plan, this alternative cannot be analyzed further in this document.

Limiting Geothermal Leasing and Exploration: Another alternative would be to limit the number of geothermal leases granted in the Planning Areas and also limit exploration so as not to exceed a certain threshold. Due to the wide range of exploration options and the variability of impacts associated with such exploration, a threshold cannot be established on the Planning Area wide level. Site-specific NEPA analysis would be required to define such thresholds. Limiting the number of leases is inconsistent with the direction set forth in the Shoshone-Eureka Resource Area Management Plan. Therefore, limiting of geothermal leasing and exploration within Shoshone-Eureka Planning Area will not be analyzed further in this document.

Denial of Geothermal Leases: The final alternative considered would be the denial of geothermal leasing in the Shoshone-Eureka Planning Area. This violates the current National Energy Policy, which supports a clean and diverse portfolio of domestic energy supplies in which geothermal energy would play a part and is inconsistent with the direction set forth in the Shoshone-Eureka Resource Area Management Plan. Therefore, Alternative Three, denial of all geothermal leasing within Shoshone-Eureka Planning Area, will not be analyzed further in this document.

CHAPTER 3.0 – AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

The following sections discuss the anticipated impacts, including cumulative impacts, that geothermal leasing and exploration would have on the human environment.

Proposed Action

General Setting

The Shoshone-Eureka Planning Area is typical of the Basin and Range Physiographic Province in Nevada. It is characterized by fault block mountain ranges, most of which are oriented in a north-south trend, separated by large valleys. Elevations range from 4,518 feet near the town of Battle Mountain to 10,187 feet at the top of Mt. Callaghan in the Toiyabe Range. Most valleys average 5,000 feet in elevation while the mountain ranges average 7,500 to 8,200 feet. Soils in the study area consist of Entisols, Aridisols, Mollisols, and Playas.

Reasonably Foreseeable Development Scenario for Geothermal Resources

Analysis of cumulative impacts is required by the CEQ regulations implementing NEPA. These regulations, at 40 CFR1508.7, state: *“Cumulative impact is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonable foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.”* This section describes reasonably foreseeable geothermal activities that might occur in the Planning Area over the next 10 years. As of the writing of this document, no proposals are known for exploration for or development of geothermal resources on private or United States Forest Service Land.

Exploration activities could create a maximum of 400 acres of new surface disturbance over the next 10 years throughout the Shoshone-Eureka Planning Area. Any exploration related surface disturbance that is not necessary for production would generally be reclaimed within three years.

Geothermal development and production are the logical result of geothermal exploration that proves an economic geothermal reservoir and should be considered as reasonably foreseeable actions. Not every lease will result in development. It is anticipated that no more than five power plants would be developed in the Shoshone-Eureka Planning Area during the next 10 years.

Each power plant, assuming development from an undiscovered resource, would require two to three years from initial interest and exploratory drilling to initial power production. Such a plant would typically operate for 15-30 years and would proceed through the following sequence: 1) 60-80 gradient holes would be drilled in the exploration phase, each 500 to 2,000 feet deep; 2) seven production wells would be drilled, each 10,000 feet deep; 3) feasibility and testing studies would be conducted; 4) site facilities and a power line would be constructed simultaneously; 5) closeout and removal of facilities; and 6) reclamation of disturbed surfaces.

Geothermal power plants are generally compact and do not have a large impact on the surface. For a typical 15 Megawatt power plant the following disturbance may be assumed: a) temperature gradient holes (minimal long term disturbance); b) production wells, access roads

and drill sites (20 acres); c) production site and facilities (10 acres); d) power line (35 to 40 acres) for a total disturbance of 65 to 70 acres. If five power plants were developed, a maximum of 350 acres would be directly affected for 15 to 30 years.

If a dehydration plant and ancillary facilities were to be constructed in the next 10 years, such a plant would require two or three production wells drilled to a depth of 4,000 to 7,000 feet, and two injection wells of similar depth. It would probably be located in a valley and in close proximity to an area that is amenable to crop production (onions, carrots, alfalfa, etc.). The wells and associated pipelines would result in about three acres of surface disturbance. Buildings required for the heat exchanges, warehouse, production, office, etc. would result in an additional 20 acres of disturbance. The facilities are assumed to be approximately 10 miles from a major road, so an access road resulting in an additional 48 acres of surface disturbance would be required. Thus, total surface disturbance related to such a hypothetical dehydration plant would be approximately 71 acres.

In addition, geothermal resources might be used to provide heat and water for up to two greenhouses. The latter would be used to grow flowers or seedlings. Such facilities would be located in a valley and would result in a surface disturbance of 71 acres for a total of 142 acres.

The recreational aspect of hot springs and wells cannot be overlooked as public interest increases and places greater demands on these resources. It is possible that two or three recreational sites would be developed, if liability issues could be satisfactorily resolved. Some recreational activities may be displaced. New surface disturbance related to recreational development would be minimal.

It is estimated that up to five individuals or companies would use geothermal resources for such domestic purposes as heating and power generation. Surface disturbance related to these domestic activities would be quite limited and would be related to access roads and / or pipelines. It is estimated that such use would disturb a total of eight acres.

Surface disturbance could occur in all parts of the Shoshone-Eureka Planning Area. It is anticipated that the majority of leasing and disturbance would occur in the vicinity of known geothermal waters, shown on Map 2. However, reservoirs lacking surface expression may exist throughout the Planning Area. More than half of Nevada's currently producing areas lacked geothermal surface expressions.

Additional impacts of reasonably foreseeable activities, including grazing, mining and irrigation, are discussed in Chapter 3 under Cumulative Impacts.

Reasonably Foreseeable Development Scenario for Geothermal Resources

Type Of Activity	Total Maximum Anticipated Surface Disturbance In Acres	Short Term Disturbance (1-3 Years) In Acres	Long Term Disturbance (15- 30 Years) In Acres
Exploration	400	400	
Power Plants (5)	350		350
Dehydration Plant (1)	71		71
Green House (2)	142		142
Recreational Development	Undetermined	Undetermined	Undetermined
Domestic Applications (5)	8		8
Total	971	400	571

Table 3

Standard Operating Procedures

The following is a list of Standard Operating Procedures that have been developed via forms, laws, regulations, and BLM policy:

1. The BLM requires roads, drill pads, and other disturbed surfaces to be watered for dust suppression as directed by the Assistant Field Manager.
2. The operator must obtain permits as required by Federal, State, and Local laws and regulations. The BLM will not permit any operation that would violate Federal, State, or County water quality regulations. All operations would be required to comply with all State and Federal regulations concerning wetlands and riparian areas.
3. Areas disturbed are to be scarified and revegetated as soon as feasible.
4. All traffic associated with exploration is required to follow routes that avoid cultural resources. Operators identify and flag anticipated routes and detours on the route.
5. A cultural inventory may be required. The decision to require a cultural inventory is made by the Assistant Field Manager for Nonrenewable Resources.

The inventory would be one of the following types:

- a. **Class I:** A review of existing historic documentation and BLM office records. This type of inventory is generally used when the proposed project is located in an area of complete disturbance, or where the area has been previously inventoried using methods consistent with existing standards
- b. **Class II:** A review of existing historic documentation and BLM office records, and some fieldwork. This type of inventory is generally used when only a portion of the project area has been disturbed, or portions of the project area have been previously inventoried using methods consistent with existing standards. It may also include a determination of significance for cultural properties located within the project area, and a determination of effect.
- c. **Class III:** A complete inventory that includes a review of existing historic documentation and BLM office records, and a complete inventory of the project area. It includes an evaluation of significance for cultural properties located within the project area and a determination of effect. This type of inventory is used in areas where there have been no previous

inventories, in areas where there has been a change in ground visibility, or in areas that were inventoried using methods not acceptable by existing standards.

6. Cattle guards, fences, and other range improvement facilities would be constructed as required by the Authorized Officer to mitigate impacts to livestock grazing and wild horses and burros.
7. All topsoils, except playas, are salvaged, stockpiled, labeled, and used for reclamation activities, including revegetation. Surface disturbance is planned and constructed so as to avoid the most easily eroded soils.
8. A visual contrast rating worksheet is prepared by the BLM for each drill site and proposed road construction. Ridges and skylines are avoided.

Critical Elements and Other Resources Checklist

Resources listed in the following table, including the fifteen “critical elements” whose review is mandated by Executive Order, regulation, or policy, have been reviewed for the proposed action and Alternative. Those marked as not affected would not be impacted by or cause impacts to the proposed action, or are not present in the area of the proposed action. Discussion of expected impacts to affected resources follows the table.

CRITICAL ELEMENTS	Present YES/NO	Affected YES/NO	OTHER RESOURCES	Present YES/NO	Affected YES/NO
Air Quality	YES	YES	Forestry	NO	NO
ACECs	NO	NO	Land Use Authorizations	YES	YES
Cultural and Historical Resources	YES	YES	Minerals	YES	NO
Environmental Justice	NO	NO	Grazing Allotment Management	YES	YES
Farmlands (Prime or Unique)	NO	NO	Recreation	YES	YES
Floodplains	NO	NO	Socioeconomics	YES	NO
Hazardous Wastes	NO	NO	Soils	YES	YES
Invasive Non-native Species	YES	YES	Vegetation	YES	YES
Migratory Birds	YES	YES	Visual Resources	YES	YES
Native American Religious Concerns	YES	YES	Wild Horse and Burros	YES	YES
Special Status Species	YES	YES	Wildlife	YES	YES
Solid Wastes	NO	NO	Water Quantity	YES	YES
Water Quality	YES	YES			
Wetlands/Riparian	YES	YES			
Wild & Scenic Rivers	NO	NO			
Wilderness	NO	NO			

Table 4

Resources Present and Brought Forward for Analysis

Air Quality

Affected Environment: Analysis of the steam produced at present at Beowawe is given in “The Chemical Composition and Estimated Minimum Thermal Reservoir Temperatures of the Principal Hot Springs of Northern and Central Nevada” USGS Open File Report, May 1974. Livestock and wildlife have used many, if not all, of the thermal springs within the Shoshone-Eureka Planning Area. Therefore, there is no reason to believe that gases emitted from the springs are in toxic concentrations. Impacts to air quality may vary from unappreciable to moderate.

a. Air Movement Patterns

The prevailing surface wind directions are from the west-southwest and from the west. An occasional invasion of cold arctic air can bring northerly winds and extremely cold temperatures. The area is subject to gale force winds throughout the year. Locally intense winds and large dust devils may pick up dry topsoil and sand to cause localized dust storms and reduce visibility. Visibility may be reduced to less than one half mile under these conditions.

During fire season, air quality and visibility can be degraded by smoke produced by fires in California and western Nevada and carried in by the prevailing winds. Air inversions often occur in the valleys. Air quality is generally good at present.

b. Temperature

Temperature variations encountered are typical of northern desert areas far removed from the tempering influence of large bodies of water. Mid summer temperature variation in excess of 50° F can be expected within a 24-hour period with high temperatures of 100° - 105° F common. During the coldest winter months, a 24-hour temperature variation of 35° F is not uncommon. Maximum winter temperatures can be expected to range from 0° F to 55° F. Minimum temperatures of -20° F are not uncommon in the valleys. Temperatures as low as -45° F could be encountered during the winter months in the higher elevations.

c. Particulate Matter

No studies of suspended particulate matter have been made to date on a Planning Area wide level. Dust, due to windstorms, is by far the predominant suspended particulate matter encountered. Areas adjoining mining and farming operations are particularly dusty at times.

d. Fumes and Noxious Gases

Sulphur dioxide, hydrogen sulphide, and related products are released to the atmosphere by some of the hot springs. The quantities are considered to be minute. Release of methane at these sites is not known at present, but quantities, if any, are inconsiderable. No comprehensive data are available on the level of concentration, areal extent, or persistence of carbon monoxide, hydrocarbons, and nitrogen oxides.

Environmental Consequences: Proposed Action: Under the proposed action, certain exploration activities, including temperature gradient well drill pads and roads, would disturb surface areas. This disturbance would lead to an increase in wind erosion and dust generation. These drill pads generally are less than one acre and seldom exceed two acres. Pollutants, such as those released during the burning of coal to generate electricity, are not a part of geothermal power generation. Small amounts of fumes emitted by vehicles and / or aircraft could result from exploration activities.

Environmental Consequences: No Action Alternative: Same as proposed action.

Cultural-Historical Resources

Affected Environment: Archaeological and historical resources exist throughout the area. These cultural resources are the remains of prehistoric, historic, and present human activities. These are nonrenewable, generally fragile, and consist of sites or locations where humans lived or conducted some activity. Prehistoric site types within the Shoshone-Eureka Planning Area include but are not limited to habitation, hunting, plant and seed gathering, education, travel, religion, and quarrying. While prehistoric sites can be found anywhere within the resource area, a majority of sites are found close to food, water sources, and Pleistocene lakeshores. Historic sites within the area include mines, towns, mining support industries such as charcoal manufacture, stage and freight routes, railroads, farms, and ranches. Technological advances allowed humans to occupy marginal areas not previously used during prehistoric periods. Cultural-historic sites may be located anywhere in the subject area.

Environmental Consequences: Proposed Action: Cultural and historic resources may exist within the boundaries of a particular geothermal lease. Exploration activities have the potential to disturb cultural and historic resources.

Issuing leases is exempted from review under Section 106 of the National Historic Preservation Act (STATE PROTOCOL AGREEMENT between The Bureau of Land Management, Nevada, and the Nevada State Historic Preservation Office, June 1999). The following exploration activities may also be excluded from cultural inventory requirements:

- 1) Vibroseis, thumpers, and conventional truck-mounted drill rig routes and operations located on constructed roads or well defined existing roads and trails,
- 2) Pedestrian routes and placement sites for hand carried geophones, cables, or similar equipment,
- 3) Cross country operations of seismic trucks and support vehicles on bare frozen ground or sufficient snow depth so that the vehicle traffic does not reveal the ground surface and disturb the ground,
- 4) One time pass routes of wheeled vehicles under 10,000GVW,
- 5) Above ground seismic blasting (Poulter Method),
- 6) Helicopter-supported activities,
- 7) Airborne geophysical surveys, and
- 8) Exploration activities defined as casual use in 43 CFR 3200.1.

Environmental Consequences: No Action Alternative: Same as proposed action.

Native American Religious Concerns

Affected Environment: Properties to which tribes attach religious and cultural significance may exist within the boundaries of a particular geothermal lease. These properties may include, but are not limited to, a variety of plant and mineral materials, petroglyph sites, religious sites, topographic features, and geothermal springs. Physical remains may or may not be present. Hot springs are closely linked to Native American religious practices. Native Americans generally believe that spirits live in the hot spring water and that any changes to the hot spring would adversely affect these spirits.

The BLM sent letters and made follow-up telephone calls to solicit input from the tribes on the locations of areas where geothermal leasing and exploration would cause concern. The goal of this preliminary effort was to reduce the potential for conflict and to reduce the amount of time it would take to process an application.

Environmental Consequences: Proposed Action: Geothermal exploration has the potential to impact Native American religious sites. Any geothermal exploration project defined as an undertaking may require Native American consultation.

Environmental Consequences: No Action Alternative: Same as for proposed action.

Special Status Species

Affected Environment: A lease area or exploration area may now or hereafter contain plants, animals, or their habitats determined to be threatened, endangered, or other special status species. BLM is required by the Endangered Species Act of 1973, as amended, to ensure that no action on the public lands jeopardizes a threatened, endangered, or proposed species. The special status species list is reviewed and / or updated annually.

In addition to Federally designated species, BLM also protects, by policy (BLM Manual Section 6840), other special status plants and animals. The list includes certain species designated as “protected” by the State of Nevada, as well as species designated as "sensitive" by the Nevada BLM State Director. BLM policy is to afford these species the same level of protection as candidate species, that is, BLM shall carry out management, consistent with the principles of multiple use, to ensure that actions that it authorizes, funds, or carries out, do not contribute to the need to list any of these species under the provisions of the Endangered Species Act.

Species	Common Name	Status
Birds		
<i>Haliaeetus leucocephalu</i>	Bald eagle	Threatened
<i>Charadrius montanus</i>	Mountain plover	Proposed Threatened
<i>Aquila chrysaetos</i>	Golden eagle	Sensitive
<i>Accipiter gentiles</i>	Northern goshawk	Sensitive
<i>Buteo regalis</i>	Ferruginous hawk	Sensitive
<i>Buteo swainsoni</i>	Swainson's hawk	Sensitive

<i>Charadrius alexandrinus nivosus</i>	Western snowy plover	Sensitive
<i>Centrocerus urophasianus</i>	Greater sage grouse	Sensitive
<i>Oreortyx pictus</i>	Mountain quail	Sensitive
<i>Pandion haliaetus</i>	Osprey	Sensitive
<i>Plegadis chihi</i>	White-faced Ibis	Sensitive
<i>Speotyto cunicularia</i>	Burrowing owl	Sensitive

Fishes

<i>Oncorhynchus henshawi</i>	Lahontan Cutthroat trout	Threatened
<i>Gila bicolor euchila</i>	Fish Creek Springs tui chub	Sensitive
<i>Gila bicolor</i> ssp.	Big Smoky Valley tui chub	Sensitive
<i>Gila bicolor</i> ssp.	Fish Lake Valley tui chub	Sensitive
<i>Rhinichthys osculus lariversi</i>	Big Smoky Valley speckled dace	Sensitive
<i>Rhinichthys osculus</i> ssp.	Monitor Valley speckled dace	Sensitive
<i>Rhinichthys osculus</i> ssp	Oasis Valley speckled dace	Sensitive

Amphibians

<i>Rana luteiventris</i>	Spotted frog	Candidate
--------------------------	--------------	-----------

Mammals

<i>Euderma maculatum</i>	Spotted bat	Sensitive
<i>Myotis ciliolabrum</i>	Small-footed myotis	Sensitive
<i>Myotis evotis</i>	Long-eared myotis	Sensitive
<i>Myotis volans</i>	Long-legged myotis	Sensitive
<i>Plecotus townsendii pallescens</i>	Pale Townsend's big-eared bat	Sensitive
<i>Plecotus townsendii townsendii</i>	Pacific Townsend's big-eared bat	Sensitive
<i>Thomomys umbrinus abstrucus</i>	Fish Spring pocket gopher	Sensitive
<i>Thomomys umbrinus curtatus</i>	San Antonio pocket gopher	Sensitive

Invertebrates

<i>Aegialia crescenta</i>	Crescent Dune aegialian scarab	Sensitive
<i>Hesperopsis graciellae</i>	MacNeill sooty wing skipper	Sensitive
<i>Pyrgulopsis wongi</i>	Wongs springsnail	Sensitive
<i>Serica</i> sp.	Crescent Dune serican scarab	Sensitive

Plants

<i>Arabis falcifructa</i>	Elko rockcress	Sensitive
<i>Arabis ophira</i>	Ophir rockcress	Sensitive
<i>Asclepias eastwoodiana</i>	Eastwood milkweed	Sensitive
<i>Astragalus funereus</i>	Black woollypod; Funeral milkvetch;	Sensitive
<i>Astragalus oophorus</i> var. <i>lonchocalyx</i>	Long-calyx eggvetch; pink e.	Sensitive
<i>Astragalus remotus</i>	Spring Mountain milkvetch	Sensitive
<i>Astragalus toquimanus</i>	Toquima milkvetch	Sensitive

<i>Astragalus uncialis</i>	Currant milkvetch	Sensitive
<i>Camissonia megalantha</i>	Cane Spring evening-primrose	Sensitive
<i>Castilleja salsuginosa</i>	Monte Neva paintbrush	Sensitive
<i>Cymopterus goodrichii</i>	Goodrich biscuitroot; G. parsley	Sensitive
<i>Epilobium nevadense</i>	Nevada willowherb	Sensitive
<i>Eriogonum anemophilum</i>	Windloving buckwheat	Sensitive
<i>Eriogonum tiehmii</i>	Tiehm buckwheat	Sensitive
<i>Jamesia tetrapetala</i>	Waxflower	Sensitive
<i>Penstemon arenarius</i>	Nevada dune beardtongue	Sensitive
<i>Phacelia minutissima</i>	Least phacelia	Sensitive
<i>Polycytenium williamsiae</i>	Williams combleaf	Sensitive
<i>Sclerocactus blainei</i>	Blaine pincushion; B. fishhook cactus	Sensitive
<i>Silene nachlingerae</i>	Jan's catchfly; Nachlinger catchfly	Sensitive
<i>Sphaeralcea caespitosa</i>	Jones globemallow	Sensitive
<i>Streptanthus oliganthus</i>	Masonic Mountain jewelflower; M. M.; twistflower	Sensitive

Of these species, sage grouse are a special and growing concern across the West. In Nevada, sage grouse populations continue to decline according to most trend indices. Ferruginous hawks are particularly sensitive to disturbance.

Environmental Consequences: Proposed Action: Geothermal exploration activities resulting in surface disturbance and / or impacting water quality and quantity within Special Status Species habitat, have the ability to adversely impact Special Status Species. Most known sage grouse wintering grounds in the Shoshone-Eureka Resource Area occur at high elevations and are not likely to be affected by geothermal leasing.

Environmental Consequences: No Action Alternative: Same as for proposed action.

Hydrology, Water Quality and Water Quantity

Affected Environment: The Basin and Range Physiographic Region is the driest in the United States, with large parts of it being classified as semiarid and arid. Annual precipitation in the valleys in Nevada ranges from 4 to 16 inches. Most groundwater resources receive their recharge from rainfall on adjacent, higher elevation mountains and ridges. Surface streams originate in these higher rainfall areas and flow through the sagebrush region. Precipitation runoff moves rapidly down the valleys and out onto the fans where it infiltrates into the alluvium.

Environmental Consequences: Proposed Action: At this time, specific foreseeable impacts to surface and ground waters resulting from geothermal exploration activities in the Planning Area are unknown. Appendix B and Appendix C provide a brief description of possible impacts to water. Specific water demands and water quality issues would be addressed on a case-by-case basis. Surface disturbance has the ability to impact water quality by increased sedimentation. Exploration techniques, such as drilling, that have the ability to change pressure within the

ground water system could cause a change in the surface expression of springs and seeps. There may be a potential lag time between when exploration activities commence and the time when possible affects to surface and / or subsurface water would become apparent.

Environmental Consequences: No Action Alternative: Same as above.

Wetlands / Riparian Zones

Affected Environment: The Shoshone-Eureka Resource Area Record of Decision Part II identifies the following Riparian and Aquatic Habitat Management Short-Term and Long-Term Management Actions:

1. Improve and maintain in good or better condition aquatic and riparian habitat on approximately 64 miles of streams in the short-term.
2. Improve approximately 250 acres of wetland habitat to benefit waterfowl and shore birds in northern Diamond Valley.
3. Improve and maintain in good or better condition approximately 500 acres of meadow, springs, and aspen groves.
4. Improve and manage aquatic habitat to support re-introduction of Lahontan cutthroat trout into streams identified as historic habitat.

BLM manuals define riparian habitat as, “a form of wetland transition between permanently saturated wetlands and upland areas. These areas exhibit vegetation or physical characteristics reflective of permanent surface or subsurface water influence.” Riparian-wetland areas are grouped into two major categories: 1) lentic, which is standing water habitat such as lakes, ponds, seeps, bogs, and meadows, and 2) lotic, which is running water habitat such as rivers, streams, and springs.

BLM Technical Reference 1737-9 defines proper functioning condition: “Riparian-wetland areas are functioning properly when adequate vegetation, landform, or large woody debris is present to dissipate stream energy associated with high water flows, thereby reducing erosion and improving water quality; filter sediment, capture bed load, and aid floodplain development; improve flood water retention and ground-water recharge; develop root masses that stabilize stream banks against cutting action; develop diverse ponding and channel characteristics to provide habitat and the water depth duration, and temperature necessary for fish production, waterfowl breeding, and other uses; and support greater biodiversity. The functioning condition of riparian-wetland areas is a result of interaction among geology, soil, water and vegetation.” BLM Technical Reference 1737-11 (lentic systems) supplements the lotic system technical reference and defines lentic riparian resources the same way they define lotic riparian resources.

In 1991, the BLM director approved the Riparian Wetland initiative for the 1990s that establishes national goals and objectives for managing riparian-wetland resources on public lands. One of the goals was to restore and maintain riparian wetland habitat so that 75 percent or more are in proper functioning condition (PFC) by 1997. The overall objective of this goal is an advanced ecological status, except where resource management objectives, including PFC, would require an earlier successional stage. This provides the widest variety of vegetation and habitat diversity for wildlife, fish, and watershed protection. This is an important consideration

because some riparian-wetland areas might function properly long before they reach an advanced ecological status.

Wetlands and riparian habitat makes up less than one percent in the Planning Area and are often the most productive areas of vegetative growth. They are crucial wildlife and fish habitat. Riparian areas within sage grouse habitats are crucial for early and late brood rearing hens. Typical riparian vegetation species include aspen, water birch, willow species, wild rose, sedge species, rush species, and Kentucky bluegrass.

Environmental Consequences: Proposed Action: Because geothermal resources often have surface expression in the form of springs, the potential for exploration near riparian habitat is high. Surface disturbance adjacent to riparian areas has the potential to adversely impact the functioning condition of riparian area's soil and watershed attributes. Additionally, active exploration adjacent to riparian areas has the potential to keep wildlife away.

Environmental Consequences: No Action Alternative: Under this alternative, important mitigation measures to reduce or eliminate adverse impacts to riparian habitats may not be implemented.

Invasive Nonnative Species

Affected Environment: Invasive nonnative species invade heavily used or disturbed areas such as highways, roadways, and private farmlands. Areas where vegetation has been removed (burned areas, mine sites, etc.) are prone to invasion by such species unless rehabilitation efforts have been successful. When invasive weeds occur along waterways and in washes, they can be spread by water. They are also spread by heavy equipment (graders, drill rigs, etc.), other vehicles, livestock, wildlife, and contaminated seed, hay, or mulch.

Environmental Consequences: Proposed Action: Seeds of invasive nonnative species may be carried onto public lands by vehicles during exploration activities and become established. These weeds may spread to areas adjacent to exploration operations. Invasive nonnative species may crowd out more desirable native vegetation destroying farmland, livestock, and wildlife grazing lands. Areas disturbed by exploration activities may be prone to invasion and establishment of invasive nonnative species.

Environmental Consequences: No Action Alternative: Same as for proposed action.

Land Use Authorizations

Affected Environment: Within the Shoshone-Eureka Planning Area, land use authorizations cover a wide variety of improvements including communication sites, telephone lines, roads, power transmission lines, and water pipelines. Most authorizations are non-exclusive and therefore compatible rights can be granted.

Environmental Consequences: Proposed Action: Leasing and subsequent exploration would be subject to valid existing rights, such as rights-of-way, leases, and easements. Therefore, the impacts of leasing and exploration would be a minor restriction of future uses. Generally,

granting a right-of-way is not necessary for exploration activities. Impacts are anticipated to be minimal due to availability of existing routes on public lands.

Environmental Consequences: No Action Alternative: The No Action Alternative impacts are essentially the same as the proposed action.

Grazing Allotment Management

Affected Environment: Livestock grazing (cattle, horses, and sheep) is a primary use of BLM lands in the Planning Area. Livestock use levels are administered through the issuance of leases and permits. Nevada BLM achieves desired livestock grazing management through the interdisciplinary evaluation and multiple use decision process. They prescribe the manner and extent of livestock grazing to meet multiple use, sustained yield, economic, and other goals and objectives. During the summer, cattle generally graze on the valley bottoms and on forest lands in the mountain ranges. During winter, they are confined to the valleys and alluvial fans. This pattern varies with the availability of water, the steepness of slope, weather, and forage supply and distribution. On BLM-administered lands in the Shoshone-Eureka Planning Area, the majority of cattle grazing occurs during the fall, winter, and spring months. Livestock depend heavily upon springs and other surface water.

Environmental Consequences: Proposed Action: A total of 571 acres are anticipated to be disturbed throughout the Planning Area in the development of geothermal resources. A maximum of 400 acres are anticipated to be disturbed in exploration activities. This would be a loss of approximately 16 AUMs throughout the Planning Area. Under this alternative, the leasing process would require less time, so the total disturbance associated with exploration may occur over a shorter time interval. Springs and surface water may be impacted by exploration.

Environmental Consequences: No Action Alternative: The total amount of disturbance and anticipated impacts are expected to be the same, however the disturbance associated with exploration may occur over a longer time interval due to more time being needed for NEPA analysis.

Recreation

Affected Environment: A wide variety of outdoor recreation activities including sightseeing, pleasure driving, rock collecting, photography, water sports, winter sports, off-road vehicle use, picnicking, camping, fishing, hiking, and hunting, occur on BLM-administered lands. Playas provide unique recreational opportunities, including windsailing. The wide range of opportunities is possible because virtually all of the public lands are accessible and offer a variety of settings suitable for different recreation activities. Some of these activities may occur on possible geothermal lease areas.

Environmental Consequences: Proposed Action: Increased traffic during exploration activities may affect recreation due to increased noise and dust levels. Drilling operations would be of short duration so impacts to recreation are expected to be low. It is not expected to diminish any of the above mentioned recreation activities; however, the recreational activities may be displaced. Also, it is possible that some new recreational sites with hot springs and / or pools would develop, most likely without authorization. These would present a potential safety hazard.

Environmental Consequences: No Action Alternative: Under the No Action Alternative, impacts to recreation in the project area would be the same as the proposed action.

Soils

Affected Environment: Soils are variable due to differences in combinations of environmental factors responsible for soil formation. Soils are divided into gravelly, sandy, clayey, and loamy on the basis of texture, and into alkali and non-alkaline soils on the basis of chemical composition. Soil texture is a result of the mechanical sorting of sediments at the time they were deposited. The presence of large accumulations of alkali salts is due to the concentration of these salts by evaporation of surface and / or ground waters. Saline soils are almost never found where soil drainage is good. Gravelly soils are generally found on lower slopes of the mountains and alluvial fans. Their extension into the valley is dependent upon the streams that built the alluvial fans. Soils in the lower part of the valleys are composed largely of clay and fine silt that has been deposited by quiet water or wind. Due to the high content of clay, these soils have a tendency to bake when they become dry. Where these soils are found, the water table is usually only a short distance below the surface and alkali salts have been accumulated on the soil surface from evaporating ground water.

Soils encountered in the Planning Area are:

A. Entisols- Areas dominated by soils on recent landscapes lacking or weakly developed. These are mineral soils that are very young and have not yet developed appreciable accumulations of soluble salts and lime. These occur in both the valley bottoms as well as the mountains.

B. Aridisols- Areas dominated by light-colored surface horizons and one or more properties characteristic to soils of arid regions. These soils are low in organic matter and may have accumulations of soluble salts and lime. Found mainly in the valley bottoms, these soils do not have water continuously available to them during the plant-growing season.

C. Mollisols- Areas dominated by soils with dark-colored fertile surface horizons that have been formed under semi-arid to sub-humid climate. These soils are rich in organic matter and are very fertile. In the resource area, these soils mainly form in the mountains with grass cover.

D. Playas- Areas that are essentially barren, flat, generally dry, undrained basins, and are often salty. They may be inundated for short, infrequent, periods of time.

Environmental Consequences: Proposed Action: Soils would be disturbed during exploration activities including road and drill pad construction. Areas disturbed vary in size from less than one acre to two acres each, totaling an anticipated maximum of 400 acres in the Planning Area. Wind and water erosion would occur on these small parcels increasing airborne dust. As the soils become compacted from use or are developed, the amount of soil lost to erosion would decline.

Environmental Consequences: No Action Alternative: Same as the proposed action.

Vegetation

Affected Environment: The major vegetation types are Flatland Greasewood type, Shadscale Type, Big Sage Type, Pinion-Juniper Type, Creek Bottom Type, Perennial Grass Type, Poisonous Plants, Riparian and Aquatic Plants, and Playas.

A. Flatland Greasewood type (4500 to 5000 feet)

This type is mainly found in the valley floors and varies from pure stands of greasewood to mixtures of greasewood, shadscale, rabbitbrush, and big sage. The understory is composed of great basin wild rye, alkali sacaton, and squirreltail. Major forbs are peppergrass and mustard. Invasive nonnative species include halogeton, Russian thistle, and cheatgrass. The first appearance of this type was probably less greasewood, rabbitbrush, big sage, shadscale, and more perennial bunch grasses. Early survey records show that meadows existed along the watercourses, but these sites are now supporting brush species.

B. Shadscale Type (5000 to 5300 feet)

This type is located mainly on the benches and low foothills and consists of shadscale, sage, rabbitbrush, budsage, and hop sage, with an understory of squirreltail, galleta, and Indian ricegrass. Some of the forbs in the understory are wild mustard, and primrose. Invasive nonnative species include halogeton, Russian thistle, and cheatgrass. This shadscale type has projections of the next higher type (big sage) in the more favorable moisture locations such as along draws and washes. There is evidence that bud sage and cheatgrass have invaded at the expense of winter fat and perennial grasses.

C. Big Sage Type (5000 to 10,000 feet)

This type takes in most of the foothills and mountains in the unit with the exception of scattered pinion-juniper and perennial grass types. Big sage, black sage, and small amounts of rabbitbrush, serviceberry, snowberry, and mountain mahogany make up the shrub cover. Giant wild rye, cheatgrass, needle and thread, galleta, Indian ricegrass, and squirreltail make up a large portion of the understory. Important forbs are lupine, filaree, and buckwheat. It is not known what this type originally looked like, but there was probably a greater amount of perennial grass than at present.

D. Pinion-Juniper Type (6000 to 8000 feet)

This type is found in localized areas throughout the Planning Area and a major portion of the lands under Forest Service administration is of this type. Big sage and rabbitbrush are intermixed with the pinion and juniper. Sandberg bluegrass, needlegrass, and cheatgrass are the most common grasses found within this type. The ground cover density in some of these areas is extremely low due to erosion, lack of suitable growing conditions, and tree canopy density.

E. Creek Bottom Type (Variable elevation)

This type exists because of favorable growing conditions. The creek bottoms are dominated by a dense stand of willow, chokeberry, cottonwood, and at the higher elevations, aspen.

F. Perennial Grass Type (8000 feet)

There are isolated areas that are mainly perennial grasses and grasslike plants (rushes-sedges). High mountain meadows and spring aprons make up most of these areas. These grasses are extremely important to livestock, wildlife, and wild horses and burros.

G. Poisonous Plants

Poisonous plants are found throughout the resource area, but no major livestock losses are known to have occurred because of them. Larkspur, locoweed, halogeton, and death camas are some of the poisonous plants.

H. Riparian and Aquatic Plants

Less than one percent of the Shoshone-Eureka Planning Area is composed of this type. It occurs along and within streams, ponds, lakes, springs, and seeps. Typical riparian vegetation includes: aspen, water birch, willow species, wild rose, sedge species, rush species, and Kentucky bluegrass. Two factors regulate the species and kind of plants that grow near springs: (1) the ability to withstand extreme and unrelenting grazing pressure, and (2) the ability to tolerate saline and / or alkaline soil and water. Because these water sources are often the only surface water within several miles (commonly up to five miles) both wildlife and livestock depend on them heavily. Livestock use is dominant, often leading to trampling and over-utilization of vegetation in the immediate vicinity of the spring. In the Shoshone-Eureka Planning Area, salt grass (*Distichlis stricta*) is the dominant species. In some cases, the water is either too hot or too mineralized to support any kind of higher vegetation at the water source.

Higher forms of plant life occur away from the water sources where the water temperature and / or mineral content is reduced to a tolerable level. In springs with relatively low water temperatures and low mineral content cattail (*Typha*), bulrushes (*Juncus*) and sedges (*Carex*) are present, if the area is large enough and wet enough to prevent their being grazed. In all instances, with increasing distance from the water source and consequent decrease in grazing and trampling and reduced irrigation, vegetation gradually reverts to the flatland greasewood type described above.

I. Playas

Less than one percent of the Planning Area is composed of lakebeds. Playas are generally devoid of vegetation due to high concentrations of salts associated with the evaporation of standing water.

Environmental Consequences: Proposed Action: The majority of the development is likely to occur in the following vegetation types: Flatland Greasewood, Shadscale, Big Sage, and possibly Playas. It is unlikely that developments would occur in Pinion-Juniper woodlands. Surface disturbing exploration activities would impact vegetation.

Environmental Consequences: No Action Alternative: Same as the proposed action.

Visual Resources

Affected Environment: The visual resource contrast rating system is used to analyze potential visual impacts of proposed projects and activities on public land. As a result of a visual resource inventory that consists of scenic quality evaluation, sensitivity level analysis, and a delineation of distance zones, BLM-administered lands are placed into one of four visual resource inventory classes. Visual resource management (VRM) objectives are established for each class (*Appendix 2 of BLM Manual H-8431-1.*)

Class I Objective: The objective of this class is to preserve the existing character of the landscape. This class provides for natural ecological changes; however, it does not preclude very limited management activity. The level of change to the characteristic landscape should be very low and must not attract attention.

Class II Objective: The objective of this class is to retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape.

Class III Objective: The objective of this class is to partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.

Class IV Objective: The objective of this class is to provide for management activities, which require major modification of the existing character of the landscape. The level of change to the characteristic landscape can be high. These management activities may dominate the view and be the major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic elements.

All BLM-administered public land within the Planning Area open to geothermal leasing fall into Visual Resource Management (VRM) Classes II – IV, predominantly Class IV. All Wilderness Study Areas within the Planning Area are managed as VRM Class I.

The following areas have been designated Class II:

- East side of Ravenswood portion of Shoshone Range
- Devil's Gate
- Pinto Canyon

The following areas have been designated Class III:

- Cortez Canyon
- East and west sides of Garden Valley
- Road Canyon
- Trout Creek
- Hickison Summit Campground
- Portions of Simpson Park Range
- Portions of Shoshone Range
- Upper Reese River Valley
- Portions of Antelope Range
- Portions of Big Smoky Valley

Environmental Consequences: Proposed Action: There would be cumulative impacts to visual resources in the short term due to exploration activity and construction. Long-term impacts to visual resources would occur due to upgrading of roads and the change in type of vegetation in areas that are reclaimed. Additional long-term impacts would result if exploration wells become producing wells.

Environmental Consequences: No Action Alternative: Same as for proposed action.

Migratory Birds

Affected Environment: A variety of migratory birds exists across the Shoshone-Eureka Planning Area. The Migratory Bird Treaty Act (MBTA) protects almost every migratory bird, with the exception of a few species such as the English sparrow and European starling.

Migratory water and shore birds depend upon the seasonal water that accumulates on playas due to impermeable clay layers.

For more information about the Migratory Bird Treaty Act, and how to avoid violations, contact the U.S. Fish and Wildlife Service, 1340 Financial Boulevard, Suite 234, Reno, Nevada 89502.

Environmental Consequences: Proposed Action: During exploration of a geothermal resource, there is a possibility that some eggs and young of migratory birds may be destroyed. Any ground clearing or other disturbance (such as the creation of cross-country access to drill sites) during the migratory bird nesting season (roughly, April through August) risks a violation of the Migratory Bird Treaty Act by destroying the eggs or young of common shrub-nesting birds such as the sage thrasher, sage sparrow, Brewer's sparrow, horned lark, and meadow lark.

Drilling on playas has the potential to breach the impermeable clay layers and result in water infiltration, instead of accumulation.

Environmental Consequences: No Action Alternative: Same as the proposed action.

Wildlife

Affected Environment: There are several vegetation types in the Shoshone-Eureka Planning Area that provide habitat for a variety of wildlife guilds for waterfowl and terrestrial birds, mammals, reptiles, amphibians, and fish. Riparian areas and surface waters are essential to wildlife. Wildlife depend heavily on springs and surface waters.

Environmental Consequences: Proposed Action: The direct removal of habitat or disturbance associated with exploration may affect individuals or groups of wildlife species. Exploration activities may impact springs and surface waters.

Environmental Consequences: No Action Alternative: Important mitigation measures may not be implemented which may reduce or eliminate adverse impacts to wildlife species.

Wild Horses and Burros

Affected Environment: Wild horses and burros are protected under the Wild Free-Roaming Horse and Burro Act of 1971. One of the main objectives of this Act is to manage wild horses and burros as an integral part of the natural system of the public lands under the principle of multiple use. Wild horses are located within Herd Management Areas (HMAs) within the Shoshone-Eureka Planning Area. Map 3 provides the location of the 12 HMAs within the Shoshone-Eureka Planning Area, which span over 1.6 million acres.

Environmental Consequences: Proposed Action: The proposed action could affect the wild horses and burros if a geothermal exploration project or production facility is located within an HMA boundary. Should geothermal exploration be located near or at a water source, wild horses and burros would be impacted, since they depend on natural water sources. The location and amount of disturbance would determine the degree to which wild horses and burros would be affected and would vary on a case-by-case basis. Since wild horses cannot be managed outside of an HMA and displacement of horses from an HMA could not occur, mitigation would be difficult. Impacts to the wild horses and burros would need to be investigated on a case-by-case basis.

Environmental Consequences: No Action Alternative: The No Action Alternative would affect horses and burros as stated in the “*Regional Environmental Analysis on Geothermal Leasing in the Shoshone Resource Area*” and “*Regional Environmental Analysis on Geothermal Leasing in the Eureka Resource Area*”. Management plans offered in these assessments may be outdated or irrelevant. The No Action Alternative may not account for changes in management techniques that have occurred over the years in the Wild Horse and Burro Program.

Mitigating Measures

The following mitigation measures are to minimize or eliminate impacts to resources analyzed in the Environmental Consequences of the proposed action.

Resource	Mitigation
Air Quality	The operator would be required to implement at the direction of the Assistant Field Manager testing of emissions for H ₂ S and other noxious / deadly gases where there is indication that these gases may occur.
Cultural-Historical Resources	Cultural resources would be avoided and mitigation measures would be developed on a case-by-case basis as required by regulations, lease terms and attached stipulations developed during site specific NEPA analysis.
Native American Religious Concerns	As surface disturbing activities occur, the BLM would require that the operator monitor the water temperature and outflow of water from local hot springs and existing wells as directed by the Assistant Field Manager. If the temperature and outflow of the water from the spring or well were impacted to a degree determined by the Assistant Field Manager to be more than negligible, the BLM would require the operator to take corrective actions. Failure of the operator to take the corrective measures as directed could result in BLM's terminating the operation.
Special Status Species	<p>The lease area may now or hereafter contain plants, animals, or their habitats determined to be threatened, endangered, or other special status species. The special status species list is reviewed and / or updated annually and as species are added, new mitigations / stipulations may add further restrictions. BLM may recommend modifications to exploration and development proposals to further its conservation and management objective to avoid BLM-approved activity that will contribute to a need to list such a species or their habitat. BLM may require modifications to or disapprove proposed activity that is likely to result in jeopardy to the continued existence of a proposed or listed threatened or endangered species or result in the destruction or adverse modification of a designated or proposed critical habitat. BLM will not approve any ground-disturbing activity that may affect any such species or critical habitat until it completes its obligations under applicable requirements of the Endangered Species Act as amended, 16 U.S.C. § 1531 <u>et seq.</u>, including completion of any required procedure for conference or consultation.</p> <p>Exploratory endeavors on the public lands would require a Special Status Species review, and may require a field survey for the presence of Special Status Species. Potential impacts to Special Status Species would be analyzed on a case-by-case basis. Mitigation measures would be developed on an individual project basis depending upon the results of the survey.</p>

Resource	Mitigation
	<p>Springs within ½ mile of exploration activities would be inventoried by BLM approved and supervised personnel for the presence of invertebrates. If a rare genus, such as <i>Pyrgulopsis</i>, is found, identification to species and monitoring of effects of the proposed action would be required and site-specific mitigation may be developed by the BLM.</p> <p>BLM could require measures listed below for activities in sage grouse and ferruginous hawk habitat.</p> <p>Sage grouse: Operations would avoid active leks (strutting grounds) by 2 miles during strutting season (see Management Guidelines for Sage Grouse and Sagebrush Ecosystems in Nevada, October 2000). Approximate dates: March 1 - May 15</p> <p>Operations would avoid nesting and brood rearing habitat (especially riparian habitat where broods concentrate beginning usually in June) by ½ mile during the time such areas are in use. Approximate dates: April 1 - August 15</p> <p>Operations would avoid sage grouse wintering habitat by ½ mile while occupied. Most known wintering grounds in the Shoshone-Eureka Resource Area occur at high elevations and are not likely to be affected. Avoidance dates would vary with severity of the winter.</p> <p>BLM would limit the disturbance to and fragmentation of all known sage grouse habitat.</p> <p>Ferruginous hawks: Operations would avoid active nests by ½ mile. Approximate dates: March 15 - July 1</p>
Hydrology and Water Quality and Quantity	<p>All applicants for exploration permits would be required to submit a surface water inventory to the Assistant Field Manager before authorization would be granted. The inventory would include a map of appropriate scale (such as 1:24,000) indicating the location of all surface water on public land within ½ mile radius from the surface-disturbing activity.</p> <p>At the commencement of surface disturbing activities for the drilling of exploration wells, the BLM would require that the drilling company monitor the water temperature and / or outflow of water from local springs and existing wells as directed by the</p>

Resource	Mitigation
	<p>Assistant Field Manager. If the temperature and outflow of the water from the spring or well were impacted to a degree determined by the Assistant Field Manager to be more than negligible, the BLM would require the operator to take corrective actions. Failure of the operator to take the corrective measures as directed could result in BLM's terminating the operation.</p> <p>Results would be reported to Federal and State agencies on the status of these hydrologic systems during drilling.</p> <p>Impacts include, but are not limited to, the following: Change in water temperature Change in discharge rate Substantial decrease in water table level Surface subsidence</p> <p>In the event of impacts to surface or subsurface waters, determined by the Assistant Field Manager to be more than negligible, or if a violation of Federal or State water quality standards occurs, the Assistant Field Manager would assess the situation, and may require the operator to amend, relocate or discontinue operations. If operations were terminated, the BLM would develop and the operator would implement remediation measures.</p> <p>Typical measures include: No use of the surface water; Limitations on the type of equipment that may be used; and Restrictions of activities during certain times of the year.</p>
Wetlands / Riparian Zones	<p>Surface waters, wetlands and riparian areas would be avoided as much as possible. No exploration activities should occur within 100 feet of riparian areas.</p> <p>The NOTICE OF INTENT TO CONDUCT GEOTHERMAL RESOURCE EXPLORATION OPERATIONS (Form 3200-9), terms and conditions, number 10 states that "Vegetation shall not be disturbed within 300 feet of waters designated by the Authorized Officer, except at approved stream crossing."</p> <p>Where surface waters, wetlands and riparian areas cannot be avoided (100 feet for non-surface disturbing exploration activities and 300 feet for surface disturbing exploration activities), mitigation would be developed on a case-by-case basis.</p> <p>Typical measures include: No use of the surface water;</p>

Resource	Mitigation
	<p>Limitations on the type of equipment that may be used; and Restrictions of activities during certain times of the year.</p> <p>The BLM would require that the drilling company monitor the temperature and outflow of water from local hot springs. If the temperature and / or outflow of water from a spring were impacted to a degree determined by the Assistant Field Manager to be more than negligible, the BLM would require the operator to take corrective action. Failure of the operator to take the corrective measures as directed could result in BLM's terminating the operation.</p>
Invasive Nonnative Species	<p>Areas to be involved in surface disturbing activities would be inventoried for the presence of invasive, nonnative species and treated if present.</p> <p>The exterior of all vehicles and heavy equipment would be cleaned by water before entering public lands to do work. To minimize the possibility for contamination, a designated wash area would be designated by the BLM and would be established and monitored by the operator in high use areas.</p> <p>The boots of operators and other persons working in the areas would be cleaned of seed before coming onto BLM lands.</p> <p>The BLM would develop and the operator would implement a weed treatment program from the time operation commences until the site is abandoned.</p> <p>Seed and mulch used to reclaim disturbed areas would be free of invasive nonnative species.</p> <p>Operator and workers would driving through or parking in areas where invasive nonnative species occur.</p> <p>When sites are abandoned, they would be inventoried for the presence of invasive nonnative species and treated if present.</p>
Land Use Authorizations	Avoid existing rights-of-way where possible. Proposed leases would not be allowed to overlap existing land use authorizations if they would adversely affect the valid existing authorization.
Allotment Management	<p>If operations cause a water source to become unavailable to livestock, the Authorized Officer may require a new well to be drilled, or another water development to be constructed in the general area to provide adequate water for livestock.</p> <p>If the lease area is within a grazing allotment, the Assistant Field Manager may require additional measures, including seasonal restrictions or no surface occupancy.</p>
Recreation	None identified.
Soils	None identified.
Vegetation	Disturbed areas would be reseeded with native or introduced plant species, depending on the site conditions. Disturbed areas would

Resource	Mitigation
	be reseeded with pure live seed (certified weed free) with the mixes in Appendix F. Native vegetation would be used wherever possible. However, to compete with invasive nonnative species, introduced species, as suggested in the seed list in Appendix F, would be used.
Visual Resources	None identified.
Migratory Birds	The BLM would limit the amount of ground clearing or other disturbance (such as the creation of cross-country access to drill sites) that an operator may do during the migratory bird nesting season. Areas to be disturbed would be surveyed, by personnel approved and supervised by the BLM to determine the existence and location of any nests. If any nests were located, the nest would be avoided by ¼ mile. If the nest area cannot be avoided, mitigation would be developed on a case-by-case basis.
Wildlife	<p>If operations cause a water source to become unavailable to wildlife, the Authorized Officer may require a new well to be drilled, or another water development to be constructed in the general area to provide adequate water for wildlife.</p> <p>If the lease area is within a wildlife management area, the Assistant Field Manager may require additional measures, including seasonal restrictions or no surface occupancy.</p>
Wild Horses and Burros	<p>If operations cause a water source to become unavailable to wild horses, the Authorized Officer may require a new well to be drilled, or another water development to be constructed in the general area to provide adequate water for the wild horses.</p> <p>If the lease area is within a HMA, the Assistant Field Manager may require additional measures for the protection of wild horses and burros, such as seasonal restrictions.</p>
All Resources	Operators would adhere to all Standard Operating Procedures as outlined in this EA, unless specifically waived by the Assistant Field Manager.
Playa	Because playas are important recreational places, apt to have cultural sites nearby and provide critical habitat for some migratory waterbirds and shorebirds, including Special Status Species such as the Snowy Plover, mitigation measures would be developed on a case-by-case basis. Mitigation may include no surface occupancy and seasonal restrictions.

Residual Impacts

Residual impacts are impacts that may still occur from the proposed action with mitigation measures. The following resources have been identified for having residual impacts:

Resource	Residual Impacts
Air Quality	As long as road and drill pads are being used, they would continue to be potential sources for dust generation.
Wetlands / Riparian Zones	None identified.
Invasive Nonnative Species	Despite even the best revegetation efforts, invasive nonnative species invade disturbed areas, as evidenced by 1999, 2000, and 2001 fires in the Shoshone-Eureka Planning Area. Disturbed areas could have invasive nonnative species become established.
Land Use Authorizations	Future land use authorizations may be restricted.
Grazing Allotment Management	A loss of no more than 571 acres (16 AUMs) is anticipated for 15 to 30 years.
Soils	The disturbance of soils inevitably leads to wind and water erosion. Some soil would be removed from disturbed areas by aeolian and alluvial processes.

Cumulative Impacts

Geothermal leasing does not involve surface-disturbing activities, so geothermal leasing would not contribute a cumulative impact to any resource.

Indirect Impacts of Exploration.

Springs and their associated flora and fauna may be impacted if groundwater drawdown occurs. The release of geothermal fluids may be toxic to some organisms. There may be a lag in time between the exploration or development activity and a noticeable change in spring water temperature and / or discharge. Other actions that use or impact the same aquifer or a related aquifer, such as irrigation, oil and gas drilling, etc., have the potential to indirectly impact flora and fauna of springs individually and / or collectively. In the Planning Area, flora and fauna including, many Special Status Species, rely heavily on springs and other surface water for their survival.

Direct Impacts of Exploration.

Based on the Reasonably Foreseeable Development Scenario for Geothermal Resources presented in Chapter 3, total of 971 acres are anticipated to be disturbed throughout the Planning Area in the exploration and development of geothermal resources. This is less than 0.025 percent of the land open for leasing in the Planning Area. A total of 571 acres are anticipated to be disturbed throughout the Planning Area by geothermal development. Exploration activities could disturb a maximum of 400 acres. A maximum of 350 acres are might to be disturbed throughout the Planning Area in development of geothermal power plants over the next 15 to 30 years. Geothermal development disturbance would be analyzed in appropriate site-specific NEPA documents. If development occurs, it would generally be in the vicinity of exploration projects. It is anticipated that no more than one power plant would be constructed in a 640-acre area.

The following cumulative impacts have been identified:

Resource	Cumulative Impacts
Air Quality	<p>Associated drill pads and roads may present dust problems until the areas stabilize and are revegetated.</p> <p>The Environmental Protection Agency (EPA) has calculated a fugitive dust emission factor of 0.38 tons of total suspended particles (TSP) per disturbed acre per year. Seventy-five (75) acres of disturbance due to exploration may result in as much as 29 tons of TSP. If the maximum acreage in the Reasonably Foreseeable Development Scenario (Chapter 3) were disturbed, these operations would result in 370 tons of TSP per year using EPA's fugitive dust emissions factor. This estimate of the TSP for the cumulative assessment area provides an unmitigated, or worst-case scenario.</p> <p>Additional dust could result from by existing surface disturbance, including mining related activities, roads, transmission lines, and mineral material sites.</p> <p>Additional fumes resulting from exploration would combine with those fumes dispelled by vehicles traveling Interstate Highway 80, US Highway 50, Nevada State Routes 278, 305, 306, 376, 722, and numerous county roads in the Planning Area. Pollutants contributed by aircraft in this area are trivial at present.</p>
Cultural-Historical Resources	Development of geothermal lease areas has the potential to affect cultural resources. Geothermal lease areas that contain cultural resources that may be affected by future exploration and geothermal development may be mitigated on a site-specific basis
Native American Religious Concerns	Development of geothermal lease areas throughout the state of Nevada has the potential to directly and indirectly affect Native American resources.
Special Status Species	Other surface disturbing activities, including mining, road construction, and urban expansion have the potential to affect Special Status Species.
Hydrology and Water Quality and Quantity	Other disturbance could include, but not be limited to, past, present, and future livestock and wild horse use, recreation, spring development projects, and groundwater drawdown associated with water diversions for agriculture. These and other water uses may exist within or in close proximity to a geothermal lease or exploration area. Mitigation may be developed on a site-specific basis.
Wetlands / Riparian Zones	Economic geothermal reservoirs are often associated with geothermal surface features. It is likely that disturbance would be concentrated in the vicinity of, though not within, riparian areas resulting from geothermal springs.
Invasive Nonnative Species	Exploration on public land has the potential to spread invasive, nonnative species. It is unknown at this time the magnitude of impact geothermal exploration would have on the spread of invasive nonnative species. Fires, road construction, mineral material pits, mining activities and constriction of transmission lines may occur within the Planning Area. These, among other

Resource	Cumulative Impacts
	types of disturbance, have the ability to spread invasive, nonnative species.
Land Use Authorizations	At this time, the total amount of land requiring rights-of-way is not known. Non-exclusive rights-of-ways are issued whenever possible.
Grazing Allotment Management	Other surface disturbing activities may occur within allotments including communication sites, transmission lines, roads, mines, wind farms and solar power facilities.
Recreation	Recreational activities, such as windsailing and off highway vehicle use are anticipated to increase in the future. Visual quality of recreation areas may be impacted by geothermal exploration.
Soils	Construction of drill pads and associated access roads may lead to increased erosion. Wind and water erosion would occur on these disturbed surfaces increasing airborne dust. As the soils become compacted from use or are developed, the amount of soil lost to erosion would decline.
Vegetation	Removal of vegetation for the construction of drill pads and associated access roads may lead to increased erosion. This disturbance would be spread throughout the Planning Area, but may concentrate around the springs and well shown on Map 2.
Visual Resources	Most of the anticipated disturbance would be on valley floors and alluvial fans. Mitigation would be developed on a site-specific basis.
Migratory Birds	Other surface disturbing activities may occur within migratory bird habitat including communication sites, transmission lines, roads, mines, wind farms and solar power facilities.
Wildlife	Other surface disturbing activities are or may occur within wildlife areas including communication sites, transmission lines, roads, mines, wind farms and solar power facilities.
Wild Horses and Burros	Other surface disturbing activities are or may occur within HMA's including communication sites, transmission lines, roads, mines, wind farms and solar power facilities.

CHAPTER 4.0 – CONTACTS AND COORDINATION

List of Preparers

Caleb Hiner	Lead Preparer
Bobbie McGonagle	Archaeologist
Jeremy Jarnecke	Hydrologist
Rich Hoops	Nevada State Office
Mary Craggett	Planning and Environmental Coordinator
Richard Kurtz	Rangeland Management Specialist
Chuck Lahr	Realty Specialist
Rob Perrin	Recreation Specialist
Shawna Richardson	Wild Horse and Burro Specialist
Mike Stamm	Wildlife Biologist

Table 5

Persons, Groups, or Agencies Contacted

Native Americans

Battle Mountain Band Te-Moak Tribe of
Western Shoshone
Duck Valley Shoshone-Paiute Tribes
Duckwater Shoshone Tribe
Elko Band Council Te-Moak Tribe of
Western Shoshone
Ely Shoshone Tribe
Fallon Paiute-Shoshone Tribe
Fort McDermitt Paiute & Shoshone Tribe
Lovelock Paiute Tribe
Pyramid Lake Paiute Tribe
South Fork Band Council Te-Moak Tribe of
Western Shoshone
Summit Lake Paiute Tribe
Walker River Paiute Tribe
Wells Band Council Te-Moak Tribe of
Western Shoshone
Western Shoshone Defense Project
Yerington Paiute Tribe

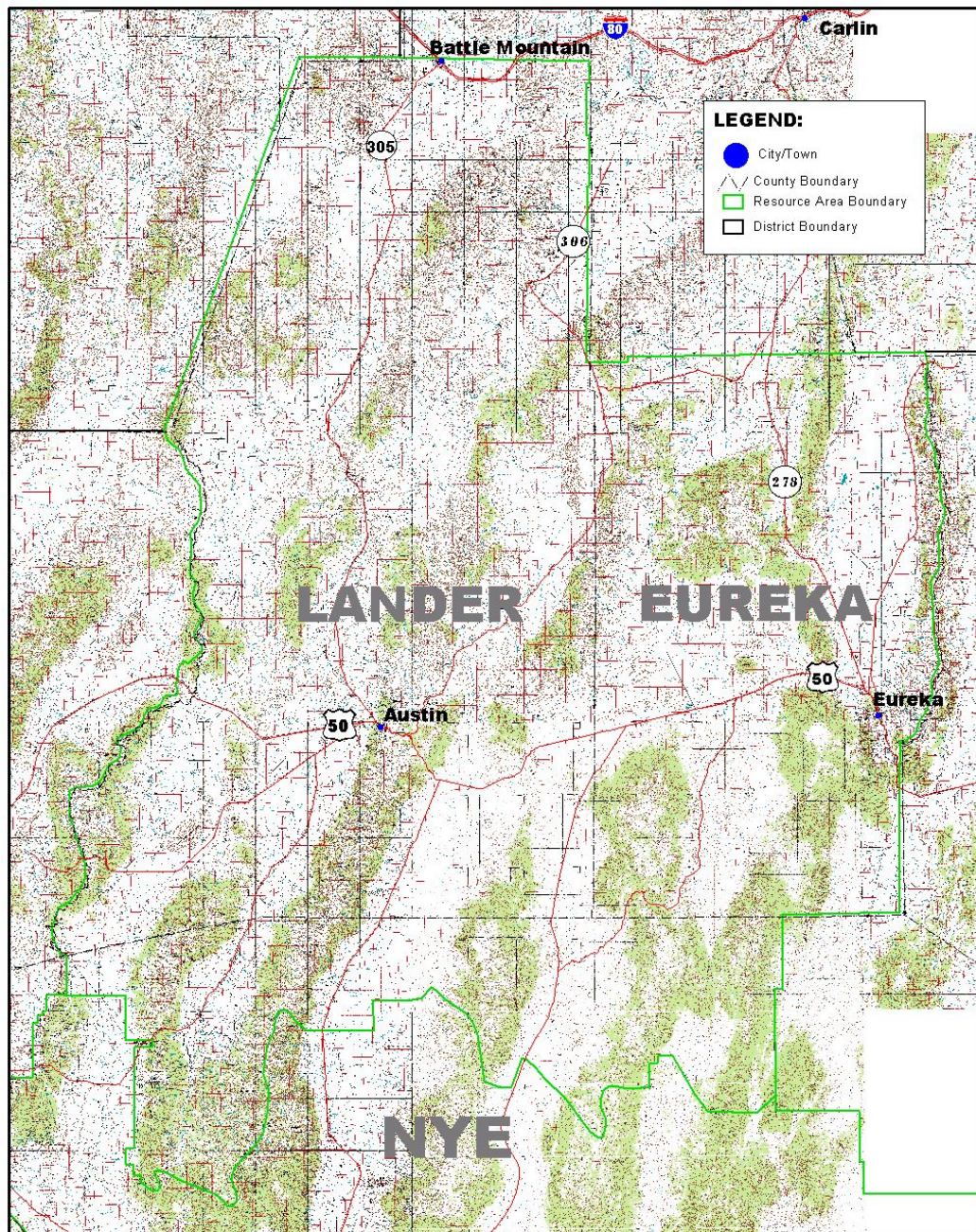
County Officials

Eureka County Commissioners
Lander County Commissioners
Nye County Commissioners

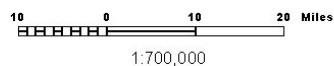
Local, State and Federal Agencies and Organizations

Great Basin Mine Watch
Historic Preservation
Mineral Policy Center
Nevada Department of Agriculture
Nevada Division of Environmental
Protection
Nevada Natural Heritage Program
State of Nevada Department of
Conservation and Natural Resources
Division of Wildlife
U.S. Fish and Wildlife Service
US EPA Region IX
Yomba Shoshone Tribe

Appendix A Maps



Shoshone - Eureka Planning Area

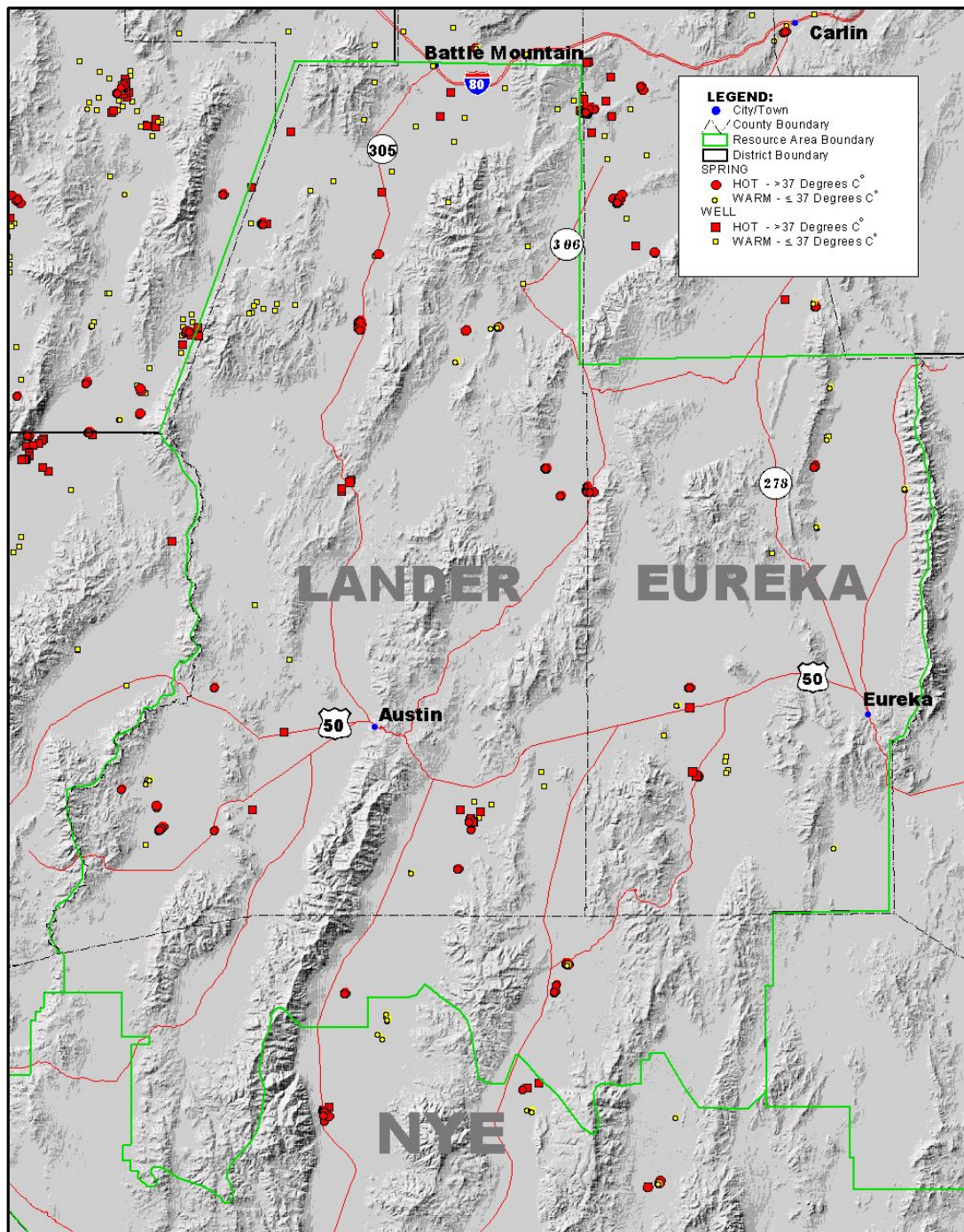


No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources. This information may not meet National Map Accuracy Standards. This product was developed through digital means and may be updated without notification.

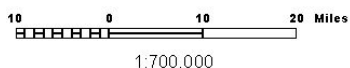


5/22/02 klg

MAP 1



Geothermal Resources

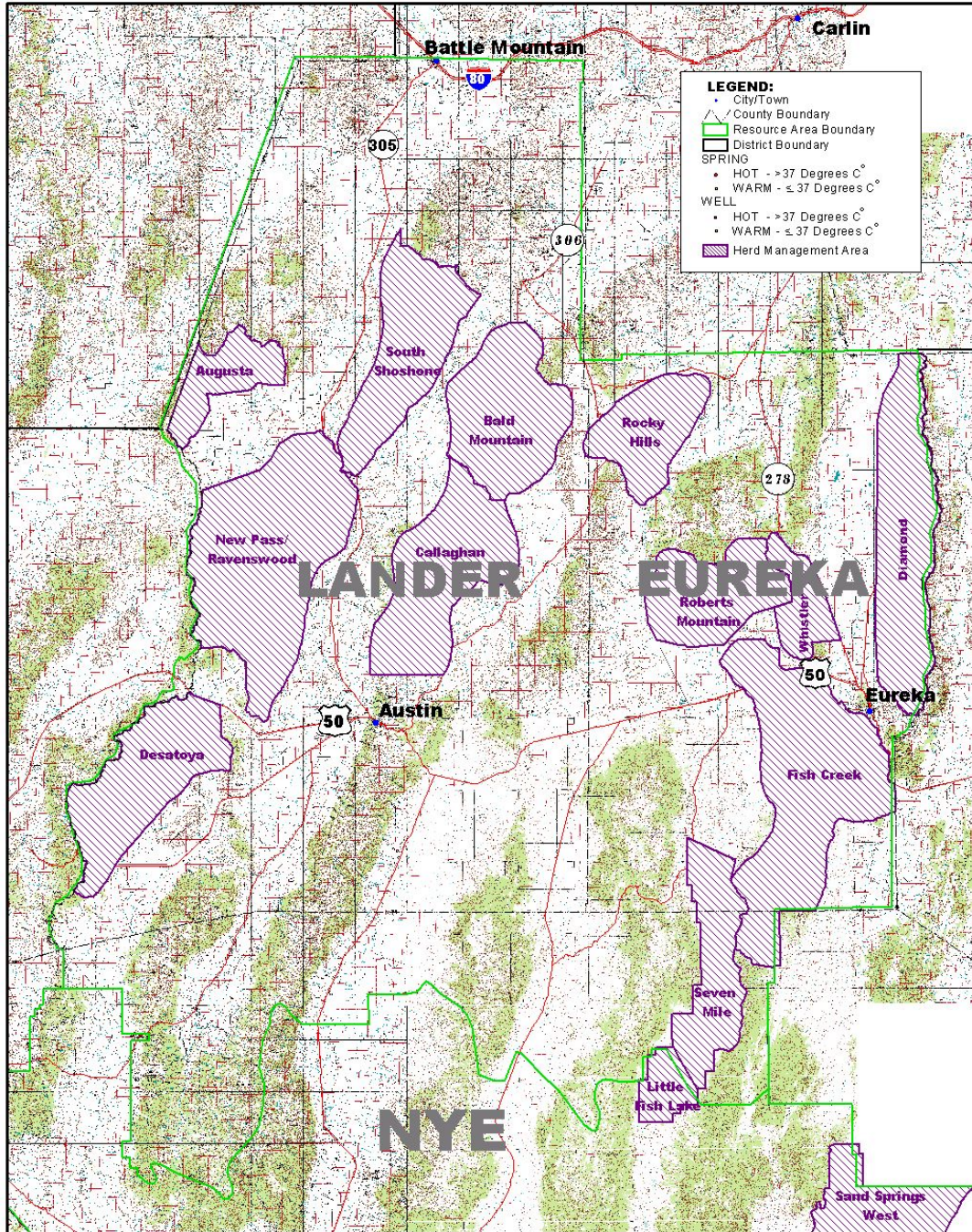


No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources. This information may not meet National Map Accuracy Standards. This product was developed through digital means and may be updated without notification.

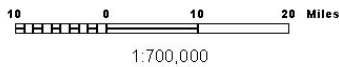


Data obtained from
Nevada Bureau of Mines and Geology
MAP 126 - Nevada Geothermal Resources
5/28/02 klg

MAP 2



Herd Management Areas



No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources. This information may not meet National Map Accuracy Standards. This product was developed through digital means and may be updated without notification.



Data obtained from
Nevada Bureau of Mines and Geology
MAP 126 - Nevada Geothermal Resources
5/28/02 klg

MAP 3

Appendix B

Technical Report

GEOTHERMAL EXPLORATION AND DEVELOPMENT PRACTICES

From Regional Environmental Analysis of Geothermal Leasing in the Shoshone Resource Area, 1974.

Stages of Implementation

Four separate stages of implementation have been identified:

1. Exploration
2. Development
3. Operation
4. Close-out

The progression from one state to the next is dependent upon the success of each earlier stage. In practice, one stage often blends into another and it would be common for exploration and development to be undertaken in one part of a geothermal field, while a production operation was going on in another part of the field. Close-out of some wells, including rehabilitation, might also be taking place at the same time.

EXPLORATION

Exploration includes all activities from the decision to explore for a geothermal field through the drilling of one or more “wildcat” (exploratory) wells.

Non-Surface Disturbing Exploration

The process of geothermal exploration and development is similar to oil and gas operation in that both generally consist of five phases, and each phase occurs in a predictable pattern that is contingent on the success or failure of the previous phase. The phases include: Preliminary and Geophysical Exploration, Exploration Drilling, Development, Production, and Abandonment. Because geothermal leases have a diligent exploration expenditure requirement, leases are typically secured prior to the initiation of preliminary or geophysical exploration work. However, such activity is nonexclusive lease right and so may be conducted by any operator.

Casual Use Exploration

Casual use activities primarily include geological reconnaissance, mapping, and geochemical analysis in an attempt to find evidence of thermal anomaly of sufficient magnitude to warrant further exploration. These types of exploration typically cause no appreciable surface disturbance or impact to resources. Vehicles used as part of these operations generally stay on existing roads or trail, or the exploration may be conducted on foot. Low-level aircraft may be used to gather additional data, including aerial photography, infrared and microwave imagery, ground penetrating radar, induced polarization, and magnetic and gravity surveys. Estimations of fluid temperature at depth can be made through an analysis of the temperature and geochemistry of surface manifestations (hot spring, geysers) and ground water. Geochemical studies are usually done in conjunction with the preparation of geologic maps using field studies, aerial photographs, and LANDSAT imagery.

Airborne exploration produces no surface disturbance. It creates only a temporary negligible impact on air quality and noise levels.

Geophysical Exploration

These types of studies often provide the first indications of the possible existence of a commercial geothermal resource and aid in defining drilling targets for production wells. Geophysical exploration activities include electrical resistivity/conductivity, magnetotelluric, gravity, magnetic, and seismic surveys. The drilling of temperature gradient wells usually follows these surveys.

Resistivity

Induced polarization (IP) surveys are the most common type of geophysical method used for geothermal exploration. IP techniques are used to measure the resistance of subsurface rocks to the passage of an electrical current. Electrodes, usually separated by two miles, are placed in the ground with an electric cable connecting them. The electrodes are either short, rods, 2 to 3 feet long, driven into the ground or aluminum foil shallowly buried over an area of several square feet. A vehicle mounted transmitter sends out a pulse of electric current, of varying frequency, into the ground through the two electrodes. Small ceramic devices that receive the current at different locations then measure the resulting field. After each measurement, one electrode is “leap-frogged” along the line to the next location and the process is repeated. This type of survey is more difficult to conduct than gravity or magnetic surveys because of the electric cables that must be strung from the transmitter to the electrodes. Off-road vehicle travel is common in this type of survey, and usually only minor surface disturbance results when the small holes are dug for the placement of the electrodes. Two or three small trucks are used to transport the crew of three to five people to transmitting and receiving sites.

Magnetotelluric Surveys

A string of potential electrodes record the variations in the natural electrical and magnetic currents in the earth. No transmitter is required. Small trucks are used to transport the crew to the work area.

Gravity and Magnetic Surveys

Gravity and magnetic surveys involve the use of portable units that are easily transported using, aircraft, ground vehicles, or walking. Off-road vehicle travel is common in both types of surveys. Minor surface disturbance occurs when small hand dug holes (about 3 inches) are dug and level surfaces (about 1 square foot) are constructed.

Seismic Survey

Reflection seismology surveys are sometimes used to explore for geothermal resources but to a lesser extent than induced polarization methods. Reflection seismology involves the collection of subsurface geologic information by recording the impulses from an artificially generated elastic shock wave. Several methods of generating the shock wave

may be used. Once the shockwave is created, it travels through the earth, reflecting off of layers within the earth. The reflected energy is recorded as a function of time using one to five pound geophones. Connected to each geophone is a cable that transports information back to a data-gathering truck. The geophones may be laid out in a variety of arrays, from a single to straight line to complex grids. A grid may cover up to two miles. Five to seven trucks are used and crew of 10-15 people is usually required. Surface mineral matter (soil) and vegetation must usually be removed from the shock wave generation site.

Methods of generating elastic shock waves are:

1. Sledgehammer- Simply hitting the ground with a sledgehammer once or multiple time.
2. Weight drop- Dropping a weight from height to the ground once of several times.
3. Vibration Method- Commonly used. A steel slab is placed on the ground and the truck (vibroiseis) is lifted into the air, similar to a hydraulic jack. The “jack” then vibrates, at a range of frequencies, resulting in shockwaves. Usually four trucks operate in unison.
4. Thumping Method- Commonly used. A truck-drawn or self-propelled unit (thumper) repeatedly drops a heavy plate to the ground to produce shock waves
5. Explosive Method- Rarely used. A truck-mounted rotary drill is used to drill holes 100-200 feet deep. These holes are loaded with 5-50 pounds of explosives and detonated to produce the shock waves.

Seismic operations are conducted on existing roads where possible, but the clearing of vegetation and rocks may be required to improve access for vibroseis, thumpers, and support vehicles. Seismic lines are usually not cleared of vegetation and appreciable impacts on resources associated with the placement of geophones are rarely observed. Vehicles may make several parallel trails in an attempt to distribute travel loads over a broader area. Travel along the line is usually a matter of one to two passes by the vehicle since the energy source is mobile and recording is done as the vehicles move down the line. Surface disturbance associated with thumpers, and vibroseis include blading and trail construction. The explosive method often requires road construction and clearing of small areas for drill operations

Temperature Gradient Wells

The most important phase of geothermal geophysical exploration is the drilling of temperature gradient wells. It is not the purpose of temperature gradient wells to find hot fluids, but rather simply to measure the amount of heat flow in a given area. Temperature gradient wells are usually drilled to a depth of 100 to 2000 feet using a truck mounted drill rig. Truck mounted drill rigs are mobile and minimal construction is necessary for access into sites on level and solid ground. In hilly or mountainous areas, more road building and site leveling may be required. During the drilling, cuttings are collected, bagged, and labeled by depth. A geologist then studies the cuttings to determine rock

age, type, porosity, and formation. Temperature probes are lowered into the hole periodically during and after drilling to measure and record the thermal gradient. This periodic monitoring may continue for over a year.

Generally, access roads for truck mounted temperature gradient wells are bladed 12 to 14 feet wide and are not crowned or ditched. When the drill site and access area consist of flat to low angle slopes, it may only be necessary to clear the access route and drill site of vegetation. Other roads may require road cuts in excess of 20 feet and fills of more than 10 feet. The average drill site requires an area of one-half acre or less of surface disturbance in order to position the truck mounted drill rig and support equipment. If high-pressure air is used to circulate the cuttings, dust may be emitted to the air when samples are collected. If mud is used, dust is greatly reduced, but a small pit is dug to contain the mud as it comes out of the drill hole. One to three days are required to drill the test hole, depending on depth and the hardness of the rocks encountered. In areas with shallow, high-pressure, water bearing zones, casing and well control equipment is required to prevent an uncontrolled discharge (blowout) and water quality degradation. Any well drilled to a depth greater than 500 feet must have blowout protection.

The surface and subsurface geological studies, the geothermal gradient studies, and other geophysical surveys are followed by the evaluation of the prospect. Only by drilling a well would the operator know if the rock formations in the prospect contain geothermal fluids of sufficient quality and quantity to provide an economic resource.

A given area may be explored several times by the same or different companies over a long period of time using one or more of the geophysical methods mentioned above. This multiple exploration may be undertaken because the initial attempts were unsuccessful, incomplete, new and different technologies and / or equipment were developed or another company wants to acquire its own information.

Exploration Drilling

Several types of drilling are utilized in the exploration phase including seismic test holes, temperature gradient wells, geologic or stratigraphic information holes, and exploration wells. The size of the equipment and the surface area needed differs with each. The type of drilling used is mainly rotary drilling or air drilling.

Seismic Test Holes-Shallow holes 100-200 feet deep are drilled with small truck-mounted rigs. Cuttings are removed by compressed air. The surface area used is just sufficient for the truck and equipment. An area of about 30 x 30 feet is disturbed by the operation. No specific drill pad is built.

Temperature Gradient Holes-Shallow holes of 300 to 500 foot depth are drilled with a truck-mounted drill rig. The holes are usually 4 to 6 inches in diameter. Mud is usually employed to remove the cuttings, and generally a portable metal mud pit is used to contain the mud, or a small pit is dug. An area of about 30 x 30 feet is disturbed by use of the drill rig and servicing water truck.

Geologic Information Holes- These holes are similar to those drilled for temperature gradient holes. Larger equipment is employed and a surface area of about 40 x 60 feet may be used. The cuttings are examined and the hole is probed with geophysical instruments to acquire data on the rock types, structure, porosity, and fluid content. Because the hole may extend to 1000 feet or more, a larger mud pit is needed. Typically, a mud pit is excavated with a bulldozer. These pits may be 10-20 feet wide by 30-50 long and 3-6 feet deep depending on the terrain and depth of the hole.

Exploration Wells-These wells are the same as development and production wells. If successful, they are generally converted to production. Drilling equipment, technology, and methods are similar to those used in oil and gas operations. Well bores of up to 24 inches in diameter may be drilled to depths of 5,000 to 10,000 feet.

Mud is generally used for the drilling. Where water flows are not encountered, compressed air may be substituted as circulation medium. At the Geysers dry steam field, for example, mud is used to the depth that temperature interferes with proper operations, then compressed air is used. Noise created during the air drilling operation is intense and approximates that of an unmuffled diesel truck.

A drill pad is leveled and cleared of vegetation. This generally involves a surface area of less than one acre to two acres. The ancillary equipment is generally also located on the drill pad. A reserve pit of approximately 1,000 to 10,000 square feet and 6-8 feet deep is often dug to contain waste fluids and drill cuttings during drilling operations.

If the reservoir pressure is sufficient to allow the well to flow on its own, it may be used to supply energy to a “flash type” power plant. If the well is not free-flowing, it would be necessary to use pumps to lift the fluids to the surface. After the pump is installed, the well may be tested to see if it is economically justifiable to install pipelines and control equipment to transport fluids to the facilities where the heat would be used.

If the well is determined to be uneconomic, it may be used for additional reservoir monitoring or plugged with cement and abandoned. The well pad and access road are recontoured and revegetated. If the well is determined to be economic it would be developed as described in the following section.

Drilling Terms, Methods and Procedures

Geothermal wells drilled for production in Nevada have ranged in depth from 200 to 15,000 feet. The deeper geothermal exploration wells may require several months or more to complete; shallower wells up, to a few thousand feet deep, may be completed in a few weeks. Larger drilling rigs and longer drill time are required to drill deep production wells.

Prior to drilling, an Application for Permit to Drill (APD) must be submitted and the operator should stake out the proposed drill pad and access road. Upon receiving the APD, an on-site inspection is conducted to assess potential impacts and provide appropriate mitigation measures. Following approval of the APD, a drill pad, ranging in

size from less than one acre to two acres, is cleared of all vegetation and leveled. The topsoil and native vegetation is usually stockpiled for use in the reclamation process. A mud pit is constructed and lined with plastic or bentonite to prevent fluid loss and possible contamination of water resources. After site preparation, the drill rig, mud pumps, generators, pipe rack, tool house, storage tanks, fuel and support facilities (office trailer, portable toilets) are brought on site. If the drill site is not large enough to hold all these facilities, an off-site staging area may be constructed. The staging area is generally a small (200 feet x 200 feet) flat spot along the side of the access road.

Drill cuttings or chips produced as the hole progresses are removed from shallow-shot holes by introducing a jet of air during drilling. For deeper drillings, a circulating medium of water or mud (a suspension in oil or water of various finely-divided substances, each possessing specific properties) is pumped down the inside of the drill pipe and allowed to return up the annular space between the hole wall and the outside of the drilling pipe. This circulating medium is used to cool and lubricate the bit as well as to return the drill cuttings to the surface. Drilling mud helps prevent caving by plastering and consolidating the walls of the hole with a clay lining, thereby making casing unnecessary during shallow drilling.

The drill rigs are very large and may be moved in pieces. Moving a dismantled rig involves use of heavy trucking equipment for transportation, and crews to erect the rig. Gross weight of vehicles may run in excess of 80,000 pounds. In order to move a drill rig and well service equipment from one site to another, and to allow access to each site, temporary roads may be built. These roads are 16 to 18 feet wide and may be as short as 200 feet or as long as ten miles or more. Bulldozers, road graders, and other types of heavy equipment are used to construct and maintain temporary roads.

The start of drilling a well is called "spudding-in". It is started by placing a short piece of tubing (conductor pipe) into the ground and cementing it in place. This prevents surface sand and dirt from sloughing into the well. Next the regular drill pit and drill string (column of drill pipe) are placed into the conductor pipe and drilling begins. The drill string passes vertically through a heavy steel drum turntable, the derrick floor, and the conductor pipe. The rotary table is geared to one or more engines, and rotates the drill string and bit. As the bit bores deeper into the earth, adding additional pipes to the upper end lengthens the drill string accordingly.

Once the hole reaches a depth of several hundred feet, another string of casing (the surface casing) is set inside the conductor pipe and cemented in place by pumping cement between the casing and the borehole wall. Surface casing acts as a safety device to protect ground water from drilling fluid contamination. Blow out preventers, called Christmas trees, are installed around the surface casing just below the derrick floor to prevent the well from "blowing-out" in the event that the drill bit encounters a high-pressure zone. In an emergency, rams inside the "Christmas tree" are automatically activated and slam shut, cutting off the drill string and sealing the hole closed.

Blow-outs are uncommon, but do occur. The basic problem is a lack of knowledge of the specific characteristics of a geothermal field. During the pioneering development of

geothermal resources, blow-outs seem to have occurred in 1-3% of the wells drilled. At the Geysers there have been three blow-outs with over 100 wells drilled. Landslides in that steep terrain caused much of the problem. While the blow-out is taking place, water, steam, and contained elements are wasted and spread on the surrounding land.

After setting the surface casing and the blow-out preventer, drilling resumes using a smaller diameter bit. Depending on well conditions, additional strings of casing may be installed before the well reaches the final depth. The production and injection segments of the well are lined with a filter and slotted casing.

Throughout the drilling time, the drilling mud brings cuttings to the surface. The cuttings are separated from the mud and sampled so that a geologist can analyze the various strata through which the bit passes. Any excess cuttings pass into the reserve pit as waste. After drilling is complete and the well is circulated with water to clean it out, several geophysical instruments may be lowered into the well to measure temperature, pressure, porosity, conductivity, and other physical characteristics of the various formations and associated fluids through which the hole passed in a process called well logging. An initial well flow test usually follows. Steam, water, and noise accompany flow testing. The water is generally directed into the reserve pit and is contained. The steam is released into the atmosphere. After an initial flow test, the drill rig is then moved off site and the well is further flow tested for 30 to 45 days. Any discharge from the well is contained in the reserve pit. After studying the information from the well logging and the results from the flow test, the economic viability of the well is determined.

Effects of Drilling

Impact on Surface Expression of Geothermal Resource

The release of pressure and water through drill holes may affect the surface expression of the geothermal field. Springs and geysers may dry up, may be renewed in a different place, or may be increased. Accurate prediction of the results of drilling on such surface features cannot be made.

Since geothermal reservoirs are typically in active fault areas, earthquakes may occasionally change the surface features by drying up, moving, or increasing thermal activity. It is thus not always possible to determine if the observed effect was caused by drilling or by natural activity.

Impact on Water

Five thousand to 15,000 gallons of water per day may be needed for mixing drilling mud, cleaning equipment, and cooling engines. A surface pipeline may be laid to a stream or a water well, or the water may be trucked to the site from nearby ponds, streams, rivers, or lakes. (For additional information on impacts to water see Appendix C.)

Rehabilitation of Exploration Activities

Rehabilitation activities vary with terrain, climate, and significance of the damage.

1. Off-road vehicular travel. Generally no rehabilitation is undertaken because the disturbance is temporary and, in most areas, heals itself in a short time.
2. Road and trail construction. Generally no rehabilitation is undertaken unless there is definite requirement for it (i.e. erosion hazard, access where none is wanted, etc.). Where needed, such roads and trails can be scarified and reseeded.
3. Drilling. Small drill hole sites are usually rehabilitated by cleaning up any debris and smoothing the area with a bulldozer where needed. Mud pits are filled and leveled. Scarifying and reseeded are performed as needed. Large exploratory wells are capped with a pressure head to prevent blow-out, and typically left in operating condition. Other structures are removed, and the drilling pad may be revegetated and scarified as needed. All holes would be abandoned in compliance with State and Federal regulations.

DEVELOPMENT

Development includes all activities from the decision to develop until production is reached. Geothermal resources can be used as an energy source in many ways including home and industrial heating, electric generation, large-scale food processing and drying. In general, geothermal resources can be used in any process or operation where heat is used as an energy source. Several conditions must first be met before geothermal fluids can be used as an economically viable energy source. For example, if geothermal fluids are to be used for home heating, the homes must be located near the geothermal well. The same is true for electric generation. The geothermal well must be near enough to the electric generating facility so that too much cooling of the resource does not occur in transportation from the well to the facility. Once the electricity is generated, it must be sold to a utility and have access to the power grid. Electrical transmission lines must be constructed so the electricity may be delivered to the sales point.

If all these conditions are met, and there is evidence that the well can yield commercial quantities of geothermal fluids, development wells are drilled. The well field is developed so that wellhead production capacity is sufficient to supply energy to the power plant to generate the amount of electricity specified in the contract while not over using the geothermal resource. The drilling of the development well would also provide additional information regarding the geothermal reservoir. Geothermal has no general spacing requirements. Therefore, on a case-by-case basis, the location of wells may be very close together if reservoir analysis results in a determination that such spacing would not adversely impact the reservoir.

Many fields go through several development phases. A field may not be considered fully developed until several power plants with associated production and injection wells are placed online and produced for several years. During each phase of development, make up wells would

also be drilled to maintain production rates. Existing wells may also be re-completed to improve production rates.

Five discrete operations are recognized:

1. Road Development
2. Drill Site Development
3. Geothermal Pipeline
4. Plant Construction
5. Transmission Lines
6. Rehabilitation

Plant construction and transmission lines are not analyzed in this environmental assessment.

Road Development

During the development stage, the road system of the area is greatly expanded. Once it is known which wells produce and their expected productive life, and the location of transmission lines and geothermal pipelines are identified, a system of permanent roads can be designed and built. Because it often takes several years to develop a field and determine field boundaries, the permanent road system is usually built in segments. For this reason, many temporary roads end up as long-term main access or haul roads. The planning of temporary roads for exploration and development wells should be done with road conversion to long-term use in mind.

Access roads are normally limited to one or two main routes to serve the lease or unit areas, with a maintained side road to each well. Upgrading of temporary roads may include ditching, draining, installing culvers, graveling, crowning, or capping the roadbed. The amount of surface area needed for roads would be similar to that for temporary roads mentioned earlier and would also be dependent on topography and loads to be transported over it. Generally, main access roads are 20 to 24 feet wide and side roads are 14 to 18 feet wide. These dimensions are for the driving surface of the road, not the maximum surface disturbance associated with ditches, back cuts or fills. Surface disturbance in excess of 130 feet is not unusual in steep terrain. The length of access road may be increased since steep slopes, deep canyons, and unstable soil areas must be circumvented in order to construct stable access to the wells and to provide for the connecting network of geothermal pipes.

Drill Site Development

The rate of development well drilling depends totally on whether the field operator has a signed sales contract and the terms of the contract. Because these contracts typically require a plant to be online within one to two years of the signing date, once development

commences, it occurs at a very rapid pace. An evaluation period to observe production performance may follow between the drilling of successive wells.

The procedure for drilling development wells is the same as for exploration wells. Often, somewhat larger equipment is used. The drill pad is leveled and cleared of vegetation. Generally, less than one acre to two acres is disturbed. A reserve pit 1,000 to 10,000 square feet and 6-8 feet deep is often excavated to contain waste fluids during the drilling operations and flow testing. The sump may be fenced to keep out animals. Any completed well is fitted with an assembly of valves, pipes, and fittings to control the flow of geothermal steam and fluids to the facility where the heat energy is to be used.

1. Water- About 500-1,000 barrels (a barrel= 42 gallons) of water per day would be used in drilling a well. This water may come from water wells drilled in the immediate vicinity (about 60 gpm (gallons per minute) flow would be adequate), from nearby surface water, or it may be hauled in by truck.
2. Spacing- Current geothermal plants require steam pressure of about 100 psi at the generator. This limits the distance steam can be piped to the generator because of heat loss. Wells are therefore generally located within one-half mile of the generation plant. Since the pipelines leading from the well to the facility are insulated, some facilities can be up to five miles from the well. The number of wells used to service a plant is dependent on the temperature of the wells (a temperature of 325-350°F at the generator is usually needed) and the characteristics of the geothermal reservoir. Generally, from 16 to 20 producing wells are used per power plant.
3. Flow Testing- To determine the sustained flow characteristics of a well, and to clean out the hole, each new well is vented to the atmosphere for a period of time, usually 30-45 days. Non-condensable gases, including carbon dioxide, methane, hydrogen, nitrogen, argon, carbon monoxide, hydrogen sulfide, radon, and ammonia and vapors of boric acid and mercury are often contained in the steam. The vapors and gases generally make up less than 3% of the total stream. When present in excessive amounts, some of these gases and vapors are toxic.

Gas	Toxicity Levels
Ammonia	50 ppm
Boric Acid	None established
Carbon dioxide	5,000 ppm
Carbon monoxide	100 ppm
Hydrogen sulfide	20 ppm
Mercury	12.2 ppb
Methane	10,000ppm

Table B1

Where present in unacceptable amounts, monitoring devices and special precautions may be necessary as a safety measure.

Additionally, very small amounts of hydrogen sulfide (as little as .025 ppm) can be detected by smell. This “rotten egg” odor, common in hot spring areas, can be an aesthetic problem.

High noise levels accompany production testing. Because of this, muffling devices are generally installed.

Geothermal Pipeline

Pipelines 10 to 30 inches in diameter would be used to transmit steam or hot water from the production wells to the power plant or processing facility. The pipes are typically insulated with fiberglass to minimize heat loss. Expansion loops or joints are placed at frequent intervals either vertically or horizontally to provide for the extreme expansion and contraction of the pipes upon production startup and shutdown.

Under present technology, pipelines are constructed above ground to provide for expansion and contraction and to enhance maintenance and detection of leaks. Underground installation is thus far uneconomical and may also present some safety hazards.

The lines form a radiating pattern on the surface, connecting wells with the power plant. They may be painted to blend with the surroundings.

Plant Construction

Generating plants are located centrally with respect to the producing wells to minimize the distance the steam or water is piped from the wells. The current spacing is about one 110 Megawatt power plant per 640 acres (one section) throughout the productive area.

At the Geysers, the average 110 Megawatt plant building is about 100 x 200 feet and three stories high. The adjacent cooling towers are about a third higher than the generating plant building. The entire generating plant cooling tower complex occupies an area of about five acres.

Transmission Lines

Power generated from the plant is transmitted via conventional power lines to the area of use. The size and location of the line is dependent upon the power output and destination.

These lines would tend to be large, considering that 1 Megawatt of plant capacity would service the power needs of about 1,000 people.

REHABILITATION OF DEVELOPMENT ACTIVITIES

Rehabilitation would be possible on disturbed areas not needed for the continued production, commensurate with terrain, climate, and significance of the damage.

1. Road Development- Roads needed for maintenance and further development would not be rehabilitated. Temporary roads and trails can be scarified and revegetated as needed.
2. Drill Site Development- After well completion, an area approximately 30 x 30 feet directly surrounding the wellhead would be needed for operation. An additional graded area of about 50 x 100 feet may be needed for moving in a drill rig to correct any problems that may develop during production. The reserve pit is generally dried out, covered with dirt and topsoil, and graded. It and the remaining area of the drill site can be rehabilitated and revegetated.
3. Plant Construction- The area disturbed in constructing the generating plant and cooling towers can be rehabilitated and revegetated. The buildings may be painted to blend with the surroundings. Some cooling towers are architecturally attractive and, if desired, may be intentionally painted to contrast with the surroundings to heighten the visual experience.
4. Geothermal Pipelines- Geothermal pipelines may be painted to blend with the surroundings and any areas not needed for access may be revegetated. At Lardarello, Italy, steam lines cross grainfields and vineyards with essentially no loss of land productivity.
5. Transmission Lines- Surface disturbance accompanying electrical transmission line construction may be rehabilitated with the exception of needed maintenance roads.

Close-out

Close-out or final abandonment takes place when energy production ceases to be economic. To date, no developed geothermal field has reached this stage. In a sense, geothermal reservoirs are renewable resources in that after a period of time, the fluids may become reheated to temperatures that are useable. Two discrete operations are expected to take place during close-out:

1. Removal of improvements
2. Restoration of surface

Removal of Improvements

The removal of improvements from a geothermal field involves:

1. Surface improvements- Removal of all structures constructed during field development and operations would be accomplished. Solid waste remaining may either be disposed of in a dump developed at the site or trucked to the nearest established dump.
2. Wells- All holes would be abandoned in compliance with all State and Federal regulations.

3. Transmission lines- Any electrical transmission lines no longer in use would be removed.

Restoration of the Surface

Surface restoration would typically be a gradual process, taking place throughout the life of the field and culminating with the final abandonment. Access roads can be ripped up, landscaped, and revegetated. Power lines can be landscaped and revegetated. Well and plant locations can similarly be treated but, because of their larger size, complete landscaping to approximate the original surface in steep terrain would not be feasible except in unusually circumstances.

Appendix C

Impact of Geothermal Development on Water Resources

Water demand for geothermal operations varies with the size of the field and the type of power plant used. The water requirements for the different phases of geothermal operations are summarized in the following table. On the basis of our current understanding of geothermal development, an average geothermal field could consist of two to three power plants producing approximately 110 to 160 Megawatts per year. Therefore, assuming the use of an isobutene plant, a conservative estimate of make-up requirements would range from 6,200 acre-feet per year to 9,300 acre-feet per year for an average field. Estimated minimum make-up water demand, assuming one isobutene power plant, would be approximately 3,100 acre-feet per year; estimated maximum make-up water demand, based on the development of a 700 Megawatt generating capacity using isobutene power plants, would be approximately 41,000 acre-feet per year.

It is important to note that these cooling water requirements need not necessarily come from local surface reservoirs or water wells, but may be obtained wholly from produced geothermal waters. The final choice to use either local or produced water would depend on availability of local water and comparison of quality, characteristics and the economics of each source.

Blow-down water produced by the cooling cycle, approximately 97 acre-feet per year per plant, usually is injected because of water quality. The difference between the make-up water and the blow-down fluid, approximately 3,000 acre-feet per year per plant, is lost through evaporation. The high concentration of dissolved solids in the return fluid precludes recycling and its use as make-up water.

Table C1
Estimated Water Demand for Geothermal Operations

Exploration	3.7 acre-ft/year ⁴
Development	3.7 acre-ft/year ⁵
Isobutane Power Plant	-3,100 acre-ft/year ⁶
Direct Steam Power Plant	+430 acre-ft/year ⁷
Flashed Steam Power Plant	-200 acre-ft/year ⁸

Water demand for power plants based on a 55 Megawatt generator and a wellhead temperature of 405°F.

⁴ Assuming 20 producing wells required per power plant.

⁵ Assuming 20 producing wells required per power plant.

⁶ Water required from either produced water or outside source.

⁷ Water in excess in Geothermal Operations

⁸ Water required from either produced water or outside source.

Appendix D

Executive Order 13212

Executive Order 13212

Actions to Expedite Energy-Related Projects

By the authority vested in me as President by the Constitution and the laws of the United States of America, and in order to take additional steps to expedite the increased supply and availability of energy to our Nation, it is hereby ordered as follows:

Section 1. Policy. The increased production and transmission of energy in a safe and environmentally sound manner is essential to the well-being of the American people. In general, it is the policy of this Administration that executive departments and agencies (agencies) shall take appropriate actions, to the extent consistent with applicable law, to expedite projects that will increase the production, transmission, or conservation of energy.

Sec. 2. Actions to Expedite Energy-Related Projects. For energy-related projects, agencies shall expedite their review of permits or take other actions as necessary to accelerate the completion of such projects, while maintaining safety, public health, and environmental protections. The agencies shall take such actions to the extent permitted by law and regulation, and where appropriate.

Sec. 3. Interagency Task Force. There is established an interagency task force (Task Force) to monitor and assist the agencies in their efforts to expedite their review of permits or similar actions, as necessary, to accelerate the completion of energy-related projects, increase energy production and conservation, and improve transmission of energy. The Task Force also shall monitor and assist agencies in setting up appropriate mechanisms to coordinate Federal, State, tribal, and local permitting in geographic areas where increased permitting activity is expected. The Task Force shall be composed of representatives from the Departments of State, the Treasury, Defense, Agriculture, Housing and Urban Development, Justice, Commerce, Transportation, the Interior, Labor, Education, Health and Human Services, Energy, Veterans Affairs, the Environmental Protection Agency, Central Intelligence Agency, General Services Administration, Office of Management and Budget, Council of Economic Advisers, Domestic Policy Council, National Economic Council, and such other representatives as may be determined by the Chairman of the Council on Environmental Quality. The Task Force shall be chaired by the Chairman of the Council on Environmental Quality and housed at the Department of Energy for administrative purposes.

Sec. 4. Judicial Review. Nothing in this order shall affect any otherwise available judicial review of agency action. This order is intended only to improve the internal management of the Federal Government and does not create any right or benefit, substantive or procedural, enforceable at law or equity by a party against the United States, its agencies or instrumentalities, its officers or employees, or any other person.

George W. Bush

THE WHITE HOUSE,
May 18, 2001.

Appendix E
Sample DNA

Worksheet

Documentation of Land Use Plan Conformance and NEPA Adequacy (DNA)
U.S. Department of the Interior
Battle Mountain Field Office

Battle Mountain Field Office
50 Bastian Road
Battle Mountain, Nevada 89820
<http://www.nv.blm.gov>

(775) 635-4000

Note: This worksheet is to be completed consistent with the policies stated in the Instruction Memorandum entitled "Documentation of Land Use Plan Conformance and National Environmental Policy Act (NEPA) Adequacy" transmitting this worksheet and the "Guidelines for Using the DNA Worksheet" located at the end of the worksheet. (Note: The signed CONCLUSION at the end of this worksheet is part of an interim step in the BLM's internal analysis process and does not constitute an appealable decision.)

A. **BLM Office:** Battle Mountain Field Office

Lease/Serial Case File No.: See Attachment A

Proposed Action Title/Type: A noncompetitive geothermal lease sale.

Location of the Proposed Action: The parcels covered in the lease applications are listed in Attachment A.

Description of the Proposed Action: A noncompetitive geothermal lease sale of certain public land in the Shoshone-Eureka Planning Area by the U.S. Department of the Interior, Bureau of Land Management, Nevada State Office pursuant to 43 CFR 3110.

Applicant (if any): The applicant(s) is / are listed in Attachment A.

B. Conformance with the Land Use Plan (LUP) and Consistency with Related Subordinate Implementation Plans

LUP Name*	<u>Shoshone-Eureka Resource Management Plan</u>	Date Released	February, 1984
LUP Name*	<u>Record of Decision</u>	Date Approved	February, 1986
Other document**			
Other document**			

***List applicable LUPs (e.g., Resource Management Plans or applicable amendments).**

****List applicable activity, project management, water quality restoration, or program plans.**

✓ The proposed action is in conformance with the applicable LUP because it is specifically provided for in the following LUP decisions:

Part II, Section E, MANAGEMENT ACTIONS NOT EXPRESSLY ADDRESSED BY THE RESOURCE MANAGEMENT PLAN, includes Minerals Objectives and Management Decisions brought forward unaltered from the Management Framework Plan. (Record of Decision p. 29) Minerals Objectives 1, 2, and 3, lead to Management Decisions 1 through 5 for locatable minerals, leasable minerals (geothermal steam), leasable minerals (sodium and potassium, etc. The objectives are:

Objective 1: Make available and encourage development of mineral resources to meet national, regional and local needs consistent with national objectives for an adequate supply of minerals.

Objective 2: Assure that mineral exploration, development and extraction are carried out in such a way as to minimize environmental and other resource damage and to provide, where legally possible, for the rehabilitation of lands.

Objective 3: Develop detailed mineral resource data in areas where different resources conflict so that informed decisions may be made that result in optimum use of the lands.

Management Decision #2, which specifically addresses geothermal steam, states: All areas designated by the BLM as prospectively valuable for geothermal steam would be open for exploration and development unless withdrawn or restricted from mineral entry. All public lands disposed of in these areas would have the geothermal resources reserved to the Federal government.

□ The proposed action is in conformance with the LUP, even though it is not specifically provided for, because it is clearly consistent with the following LUP decisions:

C. Identify applicable NEPA document(s) and other related documents that cover the proposed action.

List by name and date all applicable NEPA documents that cover the proposed action.

Shoshone-Eureka Proposed Resource Management Plan and Final Environmental Impact Statement (EIS) Date Approved: February 26, 1986

Programmatic Environmental Assessment Geothermal Leasing and Exploration
Shoshone-Eureka Planning Area (EA) Date Approved: XXXXXXXX.

List by name and date other documentation relevant to the proposed action (e.g., source drinking water assessments, biological assessment, biological opinion, watershed assessment, allotment evaluation, rangeland health standard's assessment and determinations, and monitoring report).

The Geothermal Leasing Act of December 24, 1970 authorized the leasing of geothermal resources and associated byproducts in public lands through competitive and noncompetitive leasing systems (Maley, 1985).

The Geothermal Energy Research, Development, Demonstration Act of 1974 promotes the development and utilization of geothermal resources (Maley, 1985).

BLM Manual part 6840 requires, at a minimum, management of sensitive species consistent with the principals of multiple use for the conservation of the species and their habitat, and to ensure that actions authorized do not contribute to the need to list the species as threatened or endangered.

D. NEPA Adequacy Criteria

1. Is the current proposed action substantially the same action (or is a part of that action) as previously analyzed?

Documentation of answer and explanation:

The proposed geothermal lease parcel is included in the acreage previously analyzed and designated as open for fluid minerals leasing (subject to restrictions in some areas) in the Shoshone-Eureka Planning Area. Proposals for exploration and / or development at specific sites will be examined for conformance with the Land Use Plan and analyzed for NEPA adequacy at the time the proposals are submitted. Any proposal for exploration and / or development must be analyzed as required by NEPA prior to the proposed action.

2. Is the range of alternatives analyzed in the existing NEPA document(s) appropriate with respect to the current proposed action, given current environmental concerns, interests, resource values and circumstances?

Documentation of answer and explanation:

Environmental concerns, interests, and resource values have changed little since the EIS and EA were signed. The range of alternatives in these existing NEPA document are still appropriate since the environmental constraints to fluid minerals leasing, the acres available for leasing and the areas closed to mineral leasing have not changed since the EIS or EA were finalized. In addition, all construction, operation, and maintenance activities associated with geothermal development must comply with all applicable federal, state, and local laws and regulations including those that provide for stringent environmental protection of conflicting resources.

3. Is the existing analysis adequate and are the conclusions adequate in light of any new information or circumstances (including, for example, riparian proper functioning condition [PFC] reports; rangeland health standards assessments; Unified Watershed Assessment categorizations; inventory and monitoring data; most recent Fish and Wildlife Service lists of threatened, endangered, proposed, and candidate species; most recent BLM lists of sensitive species)? Can you reasonably conclude that all new information and all new circumstances are insignificant with regard to the analysis of the proposed action?

Documentation of answer and explanation:

Yes, however the Shoshone-Eureka Resource Management Plan and ROD lacks Environmental Justice and Noxious Weeds analysis.

Resources listed in the following table were reviewed for geothermal leasing in the Programmatic Environmental Assessment Geothermal Leasing and Exploration Shoshone-Eureka Planning Area:

Air Quality	Soils
Cultural and Historical Resources	Special Status Plant and Animal Species
Grazing Allotment Management	Vegetation
Invasive Non-native species	Visual Resources
Land Use Authorizations	Water Quality
Migratory Birds	Wetlands/Riparian
Native American Religious Concerns	Wild Horse and Burros
Recreation	Wildlife
Resource	

The following were not analyzed in the Programmatic Environmental Assessment Geothermal Leasing and Exploration Shoshone-Eureka Planning Area:

ACECs	Minerals
Environmental Justice	Socio-Economic Values
Farmlands (Prime or Unique)	Solid Wastes
Floodplains	Wild and Scenic Rivers
Forestry	Wilderness
Hazardous Wastes	

The anticipated impacts to the resources listed above have not significantly changed. The proposed action will not have any adverse effect on the human health or environment of minority and low income populations. Since there is no surface disturbing activity proposed, there is no impact to noxious weeds (invasive nonnative species).

4. Do the methodology and analytical approach used in the existing NEPA document(s) continue to be appropriate for the current proposed action?

Documentation of answer and explanation:

NV063-EA02-16
Appendix E

The methodology and analytical approach used in the existing NEPA document remains appropriate, as geothermal leasing creates no impact to the environment. The lease infers upon the holder the right to use as much of the land as is necessary to explore for, drill for, mine, extract, remove and dispose of all the geothermal resources in a leasehold, subject to stipulations, restrictions, and reasonable measures to minimize adverse impacts to other resources. The right to use the land for these purposes does not authorize the leaseholder to create any surface disturbance or cause any impact to the environment. Proposals that may create impacts to the environment (exploration and / or development) will be examined for conformance with the Land Use Plan and analyzed for NEPA adequacy at the time the proposals are submitted. Any issued geothermal leases located on BLM-administered public land will be subject to the mitigating measures created in the programmatic geothermal EA signed January 2002.

5. Are the direct and indirect impacts of the current proposed action substantially unchanged from those identified in the existing NEPA document(s)? Does the existing NEPA document analyze site-specific impacts related to the current proposed action?

Documentation of answer and explanation:

Yes. Geothermal lease sales and the subsequent rights inferred upon the leaseholder do not create direct or indirect impacts to public lands. The impacts of the current proposed action are substantially unchanged.

6. Can you conclude without additional analysis or information that the cumulative impacts that would result from implementation of the current proposed action are substantially unchanged from those analyzed in the existing NEPA document(s)?

Documentation of answer and explanation:

Yes. The cumulative impacts to public lands would remain unchanged from that analyzed in the Programmatic EA. The proposed action does not authorize any surface or subsurface use or disturbance; therefore, there will be no cumulative impact. The *Programmatic Environmental Assessment Geothermal Leasing and Exploration Shoshone-Eureka Planning Area* approved XXXXXX analyzed cumulative impacts on relevant resources. New mitigating measures were developed during the analysis to address any adverse impacts to these resources.

7. Are the public involvement and interagency review associated with existing NEPA document(s) adequate for the current proposed action?

Documentation of answer and explanation:

Yes, the lands involved with the lease application are identified in both the Shoshone-Eureka RMP and EIS as available for fluid mineral leasing. Further, the lands involved were analyzed in the EA. Consultation with other agencies is not required for lease sales involving BLM-administered land. Interagency review by the U.S. Fish and Wildlife Service is required prior to approval of an Application for Permit to Drill or other lease operations and will be requested at the time the proposals are submitted.

E. Interdisciplinary Analysis: Identify those team members conducting or participating in the preparation of this worksheet.

Name	Resource Represented
Caleb Hiner	Geology
Roberta McGonagle	Archaeology
Mike Stamm	Wildlife Biology (including Special Status Species)
Richard Kurtz	Range
Rob Perrin	Recreation
Chuck Lahr	Realty
Joe Ratliff	Air Quality, Water Quality, Invasive Nonnative Species, Soils
Mike Neff	Reclamation
Shawna Richardson	Wild horses and burros
Jeremy Jarnecke	Hydrology

F. Mitigation Measures: List any applicable mitigation measures there were identified, analyzed, and approved in relevant LUPs and existing NEPA document(s). List the specific mitigation measures or identify an attachment that includes those specific mitigation measures. Document that these applicable mitigation measures must be incorporated and implemented.

See Attachment B for mitigation measures.

Proposals for exploration and / or development at specific sites will be examined for conformance with the LUP and analyzed for NEPA adequacy at the time the proposals are submitted. Any proposal for exploration and / or development must be analyzed as required by NEPA prior to the approval of the proposed action.

CONCLUSION:

- ✓ Based on the review documented above, I conclude that this proposal conforms to the applicable land use plan and that the NEPA documentation fully covers the proposed action and constitute BLM's compliance with the requirements of NEPA.

Mary Craggett, Planning and Environmental Coordinator

Date

Gail G. Givens, Assistant Field Manager, Battle Mountain

Date

Note: The signed Conclusion on this Worksheet is part of the BLM's internal decision process and does not constitute an appealable decision.

**UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
Battle Mountain Field Office**

Battle Mountain Field Office
50 Bastian Road
Battle Mountain, Nevada 89820
<http://www.nv.blm.gov>
(775) 635-4000

Decision Record/ Finding of No Significant Impact

Decision

It is my decision to approve the proposed action subject to stipulations and mitigation measures identified, which are hereby incorporated into this decision.

Rationale

- 1) The proposed action is in conformance with and is consistent with the Shoshone-Eureka Resource Management Plan.
- 2) Based on the analysis, it is determined that the proposed action will not result in any undue or unnecessary environmental degradation of the public lands and is consistent with federal, state, and local laws, regulations, and plans.
- 3) The proposed action would not adversely impact any threatened or endangered species or significant scientific, cultural, or historical values.

Finding of No Significant Impact (FONSI)

Based on the analysis of the EA and implementation of stipulations and monitoring and mitigation measures identified, I have determined that the quality of the human environment will not significantly be impacted as a result of this decision. Preparation of an environmental impact statement (EIS) pursuant to Section 102(2)(C) of the National Environmental Policy Act (NEPA) is not required for the following reasons:

- 1) Sensitive resource values will not be adversely impacted from implementation of the proposal action.
- 2) There would be no adverse affect on threatened or endangered, or Nevada State Sensitive Species within the project area.
- 3) The project will not adversely affect or cause destruction of significant scientific, cultural, or historical resources.
- 4) The proposed action will not adversely affect public health or safety. The project and its potential effects on the human environment are not highly uncertain and do not involve unique or unknown risks.

Authorized Officer Signature

Date

NV063-EA02-16
Appendix E

Guidelines for Using the DNA Worksheet and Evaluating the NEPA Adequacy Criteria

These guidelines supplement the policies contained in the Instruction Memorandum entitled

“Documentation of Land Use Plan Conformance and National Environmental Policy Act (NEPA) Adequacy.” During preparation of the worksheet, if you determine that one or more of the criteria are not met, you do not need to complete the worksheet. If one or more of these criteria are not met, you may reject the proposal, modify the proposal, or complete appropriate NEPA compliance (EA, EIS, Supplemental EIS, or CX if applicable) and plan amendments before proceeding with the proposed action.

Criterion 1. Is the current proposed action substantially the same action (or is a part of that action) as previously analyzed? Explain whether and how the existing documents analyzed the proposed action (include page numbers). If there are differences between the actions included in existing documents and the proposed action, explain why they are not considered to be substantial.

Criterion 2. Is the range of alternatives analyzed in the existing NEPA document(s) appropriate with respect to the current proposed action, given current environmental concerns, interests, and resource values? Explain whether the alternatives to the current proposed action that were analyzed in the existing NEPA documents and associated records constitute appropriate alternatives with respect to the current proposed action, and if so, how. Identify how current issues and concerns were addressed within the range of alternatives in existing NEPA documents. If new alternatives are being raised by the public to address current issues and concerns, and you conclude they do not need to be analyzed, explain why.

Criterion 3. Is the existing analysis valid in light of any new information or circumstances?

If new information or new circumstances, including the items listed below, are applicable, you need to demonstrate that they are irrelevant or insignificant as applied to the existing analysis of the proposed action. New information or circumstances could include the following:

- a. New standards or goals for managing resources. Standards and goals include, but are not limited to, BLM’s land health standards and guidelines, recovery plans for listed species prepared by the Fish and Wildlife Service or National Marine Fisheries Service, requirements contained in agency habitat conservation strategies, a biological opinion, or a conference report related to Section 7 of the Endangered Species Act; Environmental Protection Agency water quality regulations for Total Maximum Daily Loads (TMDLs) (40 CFR 130); and the requirement to address disproportionate impacts on minority populations and low income communities (E.O. 12898).

- b. Changes in resource conditions within the affected area where the existing NEPA analyses were conducted, for example, changes in habitat condition and trend; changes in the legal status of listed, proposed, candidate, and BLM-designated sensitive species; water quality, including any identified impaired water bodies under Section 303 of the Clean Water Act; air quality; vegetation condition and trend; soil stability; visual quality; cultural resource condition; wildlife population trend(s); etc.
- c. Changes of resource-related plans, policies, or programs of State and local governments, Indian tribes, or other Federal agencies, such as, State- or Environmental Protection Agency-approved water quality restoration plans.
- d. Designations established in the affected area since the existing NEPA analysis and documentation was prepared. Designations include, but are not limited to, designated wilderness, wilderness study areas, National Natural Landmarks, National Conservation Areas, National Monuments, National Register properties, Areas of Critical Environmental Concern, Research Natural Areas, areas designated under the source Water Protection Program of the State or the Environmental Protection Agency, and listing of critical habitats by the Fish and Wildlife Service.
- e. Other changed legal requirements, such as changes in statutes, case law, or regulations.

Criterion 4. Do the methodology and analytical approach used in the existing NEPA document(s) continue to be appropriate for the proposed action? Explain how the methodologies and analytical approach used in the existing NEPA document(s) are current and sufficient for supporting approval of the proposed action. If valid new technologies and methodologies exist (e.g., air quality modeling), explain why it continues to be reasonable to rely on the method previously used.

Criterion 5. Are the direct and indirect impacts of the current proposed action substantially unchanged from those analyzed in the existing NEPA document(s)? Does the existing NEPA document(s) analyze site-specific impacts related to the current proposed action? Review the impact analysis in the existing NEPA document(s). Explain how the direct and indirect impacts of the proposed action are analyzed in the existing NEPA documents, and would, or would not, differ from those identified in the existing NEPA document. Consider the effect new information or circumstances may have on the environmental impacts predicted in the existing NEPA document. Consider whether the documents sufficiently analyze site-specific impacts related to the current proposed action.

Criterion 6. Are the reasonably foreseeable cumulative impacts that would result from implementation of the proposed action substantially unchanged from those identified in the existing NEPA document(s)? Would the current proposed action, if implemented, change the cumulative impact analysis? Consider the impact analysis in

existing NEPA document(s), the effects of relevant activities that have been implemented or projected since existing NEPA documents were completed, and the effects of the current proposed action.

Criterion 7. Is the public involvement and interagency review associated with existing NEPA document(s) adequately for the current proposed action? Explain how the nature of public involvement in previous NEPA documents remains in compliance with NEPA public involvement requirements in light of current conditions, information, issues, and controversies.

Appendix F Seed Mixtures

Salt Desert Shrub Community

Shrubs (Use four of the following shrubs at the rates identified.)

Species common and scientific names	pounds/acre (Pure Live Seed)
Fourwing saltbush ² (<i>Atriplex canescens</i>)	4.0
Shadescale ² (<i>Atriplex confertifolia</i>)	4.0
Winterfat (<i>Ceratoides lanata</i>)	4.0
Forage kochia (<i>Kochia prostrata</i>)	0.5
Nevada Mormon tea (<i>Ephedra nevadensis</i>)	10.0
Spiny hopsage (<i>Grayia spinosa</i>)	2.0
Douglas rabbitbrush (<i>Chrysothamnus viscidiflorus</i>)	0.5

Forbs (Use two of the following forbs at the rates identified.)

Species common and scientific names	pounds/acre (Pure Live Seed)
Scarlet globemallow (<i>Sphaeralcea coccinea</i>)	0.50
Palmer penstemon (<i>Penstemon palmeri</i>)	0.25
Lewis flax (<i>Linum lewisii</i>)	0.75

Grasses (Use four of the following grasses at the rates identified.)

Species common and scientific names	pounds/acre (Pure Live Seed)
Crested wheatgrass (<i>Agropyron cristatum</i>)	1.0
Indian ricegrass (<i>Oryzopsis hymenoides</i>)	1.0
Great Basin wildrye (<i>Elymus cinereus</i>)	1.0
Bottlebrush squirreltail (<i>Sitanion hystrix</i>)	1.0
Inland saltgrass (<i>Distichlis spicata stricta</i>)	0.5
Alkali sacaton (<i>Sporobolus airoides</i>)	0.1
Russian wildrye (<i>Elymus junceus</i>)	1.0

Wyoming Sagebrush Community

Shrubs (Use four of the following shrubs at the rates identified.)

Species common and scientific names	pounds/acre (Pure Live Seed)
Wyoming big sagebrush (<i>Artemisia tridentata wyomingensis</i>)	0.10
Fourwing saltbush (<i>Atriplex canescens</i>) ²	2.00
Spiny hopsage (<i>Grayia spinosa</i>)	1.00
Forage kochia (<i>Kochia prostrata</i>)	0.25
Nevada Mormon tea (<i>Ephedra nevadensis</i>)	4.00

Forbs (Use three of the following forbs at the rates identified.)

Species common and scientific names	pounds/acre (Pure Live Seed)
Scarlet globemallow (<i>Sphaeralcea coccinea</i>)	0.50
Palmer penstemon (<i>Penstemon palmeri</i>)	0.50
Lewis flax (<i>Linum lewisii</i>)	1.00
Sweetvetch (<i>Hedysarum boreale</i>)	2.00

Grasses (Use three of the following grasses at the rates identified.)

Species common and scientific names	pounds/acre (Pure Live Seed)
Crested wheatgrass (<i>Agropyron cristatum</i>)	2.0
Indian ricegrass (<i>Oryzopsis hymenoides</i>)	2.0
Great Basin wildrye (<i>Elymus cinereus</i>)	2.0
Bottlebrush squirreltail (<i>Sitanion hystrix</i>)	2.0

Mountain Brush Community

Shrubs (Use three of the following shrubs at the rates identified.)

Species common and scientific names	pounds/acre (Pure Live Seed)
Snowberry (<i>Symphoricarpos</i> sp.)	4.00
Serviceberry (<i>Amelanchier</i> sp.)	4.00
Antelope bitterbrush (<i>Purshia tridentata</i>)	8.00
Curl-leaf Mountain Mahogany (<i>Cercocarpus ledifolius</i>)	8.00
Currant (<i>Ribes</i> sp.)	0.50

Forbs (Use four of the following forbs at the rates identified.)

Species common and scientific names	pounds/acre (Pure Live Seed)
Yarrow (<i>Achillea</i> sp.)	0.10
Palmer penstemon (<i>Penstemon palmeri</i>)	0.25
Lewis flax (<i>Linum lewisii</i>)	1.00
Arrowleaf balsamroot (<i>Balsamorhiza sagittata</i>)	2.00
Common sainfoin	6.00
Cinquefoil (<i>Potentilla</i> sp.)	0.10
Small burnet (<i>Sanguisorba minor</i>)	4.00

Grasses (Use three of the following grasses at the rates identified.)

Species common and scientific names	pounds/acre (Pure Live Seed)
Idaho fescue (<i>Festuca idahoensis</i>)	1.0
Indian ricegrass (<i>Oryzopsis hymenoides</i>)	1.0
Orchardgrass (<i>Dactylis glomerata</i>)	0.5
Great Basin wildrye (<i>Elymus cinereus</i>)	1.0
Bluebunch wheatgrass (<i>Agropyron spicatum</i>)	1.0
Nevada bluegrass (<i>Poa nevadensis</i>)	0.5
Mountain brome (<i>Bromus carinatus</i>)	2.0

Trees As recommended on individual basis:

Species common and scientific names
Jeffrey pine (<i>Pinus jeffreyi</i>)
Limber pine (<i>Pinus flexilis</i>)
Ponderosa pine (<i>Pinus ponderosa</i>)

(Taken from Seed Mixtures for Revegetation of Disturbed Lands Environmental Assessment NV062-EA-99-23.)

APPENDIX G

Stipulations

When issuing a lease or approving a permit, the BLM may include stipulations from the following list to mitigate potential site-specific impacts. Which stipulations are included in any given authorization will depend upon findings from the Documentation of NEPA Adequacy (DNA) and input from resource specialists. For example, measures to protect wild horses and burros will be included only when those animals are known to be present on the land under consideration for lease or exploration.

Resource	Stipulation
Air Quality	The operator will implement at the direction of the Assistant Field Manager testing of emissions for H ₂ S and other noxious / deadly gases where there is indication that these gases may occur.
Cultural-Historical Resources	Cultural resources shall be avoided and mitigation measures shall be developed on a case-by-case basis as required by regulations, lease terms and attached stipulations developed during site specific NEPA analysis.
Native American Religious Concerns	As surface disturbing activities occur, the BLM will require the operator to monitor the water temperature and outflow or water from local hot springs and existing wells as directed by the Assistant Field Manager. If the temperature and outflow from the spring or well were impacted to a degree determined by the Assistant Field Manager to be more than negligible, the BLM shall require the operator to take corrective actions. Failure of the operator to take the corrective measures as directed will result in BLM terminating the operation.
Special Status Species	<p>The lease area may now or hereafter contain plants, animals, or their habitats determined to be threatened, endangered, or other special status species. The special status species list is reviewed and / or updated annually and as species are added, new stipulations may add further restrictions. BLM may recommend modifications to exploration and development proposals to further its conservation and management objective to avoid BLM-approved activity that will contribute to a need to list such a species or their habitat. BLM may require modifications to or disapprove proposed activity that is likely to result in jeopardy to the continued existence of a proposed or listed threatened or endangered species or result in the destruction or adverse modification of a designated or proposed critical habitat. BLM will not approve any ground-disturbing activity that may affect any such species or critical habitat until it completes its obligations under applicable requirements of the Endangered Species Act as amended, 16 U.S.C. § 1531 <i>et seq.</i>, including completion of any required procedure for conference or consultation.</p> <p>Exploratory endeavors on the public lands will require a Special</p>

Resource	Stipulation
	<p>Status Species review, and may, at the direction of the Assistant Field Manager, require a field survey for the presence of Special Status Species. Potential impacts to Special Status Species will be analyzed on a case-by-case basis. Mitigation measures shall be developed on an individual project basis depending upon the results of the survey.</p> <p>Springs within ½ mile of exploration activities shall be inventoried by BLM approved and supervised personnel for the presence of invertebrates. If a rare genus, such as <i>Pyrgulopsis</i>, is found, identification to species and monitoring of effects of the proposed action shall be required and site-specific mitigation may be developed by the BLM.</p> <p>Sage grouse: BLM will require operations to avoid active leks (strutting grounds) by 2 miles during strutting season (see Management Guidelines for Sage Grouse and Sagebrush Ecosystems in Nevada, October 2000). Approximate dates: March 1 - May 15</p> <p>Operations shall avoid nesting and brood rearing habitat (especially riparian habitat where broods concentrate beginning usually in June) by ½ mile during the time such areas are in use. Approximate dates: April 1 - August 15</p> <p>BLM will require operations to avoid sage grouse wintering habitat by ½ mile, while occupied. Most known wintering grounds in the Shoshone-Eureka Resource Area occur at high elevations and are not likely to be affected. Avoidance dates will vary with severity of the winter.</p> <p>BLM will limit the disturbance to and fragmentation of all known sage grouse habitat.</p> <p>Ferruginous hawks: Operations shall avoid active nests by ½ mile. Approximate dates: March 15 - July 1</p>
Hydrology and Water Quality and Quantity	<p>All applicants for exploration permits will be required to submit a surface water inventory to the Assistant Field Manager before authorization may be granted. The inventory will include a map of appropriate scale (such as 1:24,000) indicating the location of all surface water on public land within ½ mile radius from the surface-disturbing activity.</p> <p>At the commencement of surface disturbing activities for the drilling of exploration wells, the BLM will require that the drilling company monitor the water temperature and outflow of water from local springs</p>

Resource	Stipulation
	<p>and existing wells as directed by the Assistant Field Manager. If the temperature and / or outflow of the water from the spring or well were impacted to a degree determined by the Assistant Field Manager to be more than negligible, the BLM will require the operator to take corrective actions. Failure of the operator to take the corrective measures as directed will result in BLM terminating the operation.</p> <p>Results will be reported to Federal and State agencies on the status of these hydrologic systems during drilling.</p> <p>Impacts include, but are not limited to, the following: Change in water temperature Change in discharge rate Substantial decrease in water table level Surface subsidence</p> <p>In the event of impacts to surface or subsurface waters, determined by the Assistant Field Manager to be more than negligible, or if a violation of Federal or State water quality standards occurs, the Assistant Field Manager will assess the situation, and may require the operator to amend, relocate or discontinue operations. If operations are terminated, the BLM will develop and the operator shall implement remediation measures.</p> <p>Additional stipulations may include: No use of the surface water; Limitations on the type of equipment that may be used; and Restrictions of activities during certain times of the year (seasonal restrictions).</p>
Wetlands / Riparian Zones	<p>BLM will direct the operator to avoid surface waters, wetlands and riparian areas. No exploration activities will occur within 100 feet of surface waters, wetlands or riparian areas.</p> <p>Vegetation shall not be disturbed within 300 feet of waters designated by the Authorized Officer, except at approved stream crossing.</p> <p>Where surface waters, wetlands and riparian areas cannot be avoided (100 feet for non-surface disturbing exploration activities and 300 feet for surface disturbing exploration activities), mitigation will be developed on a case-by-case basis.</p> <p>Additional stipulations may include: No use of the surface water; Limitations on the type of equipment that may be used; and Restrictions of activities during certain times of the year (seasonal</p>

Resource	Stipulation
	<p>restrictions).</p> <p>The BLM will require that the drilling company monitor the temperature and outflow of water from local hot springs. If the temperature and / or outflow of water from a spring were impacted to a degree determined by the Assistant Field Manager to be more than negligible, the BLM will require the operator to take corrective action. Failure of the operator to take the corrective measures as directed will result in BLM terminating the operation.</p>
Invasive Nonnative Species	<p>Areas to be involved in surface disturbing activities will be inventoried for the presence of invasive, nonnative species and treated if present.</p> <p>The exterior of all vehicles and heavy equipment shall be cleaned by water before entering public lands to do work. To minimize the possibility for contamination, a designated wash area will be designated by the BLM and shall be established and monitored by the operator in high use areas.</p> <p>The boots of operators and other person working in the areas shall be cleaned of seed before coming onto BLM lands.</p> <p>The BLM will develop and the operator shall implement a weed treatment program from the time operation commences until the site is abandoned.</p> <p>Seed and mulch used to reclaim disturbed areas shall be free of invasive nonnative species.</p> <p>Operators and workers shall avoid driving through or parking in areas where invasive nonnative species occur.</p> <p>When sites are abandoned, they will be inventoried for the presence of invasive nonnative species and treated if present.</p>
Land Use Authorizations	BLM will require proposals to avoid existing rights-of-way where possible. Proposed leases shall not overlap existing land use authorizations if they would adversely affect the valid existing authorization.
Allotment Management	<p>If operations cause a water source to become unavailable to livestock, the Authorized Officer will require a new well to be drilled, or another water development to be constructed in the general area to provide adequate water for livestock.</p> <p>If the lease area is within an allotment, the Assistant Field Manager may require additional measures, including seasonal restrictions or no surface occupancy.</p>
Recreation	None identified.
Soils	None identified.
Vegetation	Disturbed areas will be reseeded with native or introduced plant species, depending on the site conditions. Disturbed areas will be reseeded with pure live seed (certified weed free) with the mixes in

Resource	Stipulation
	Appendix F. Native vegetation will be used wherever possible. However, to compete with invasive nonnative species, introduced species, as suggested in the seed list in Appendix F, will be used.
Visual Resources	None identified.
Migratory Birds	The BLM will limit the amount of ground clearing or other disturbance (such as the creation of cross-country access to drill sites) that an operator may do during the migratory bird nesting season. Areas to be disturbed shall be surveyed by personnel approved and supervised by BLM to determine the existence and location of any nests. If any nests are located, the nest will be avoided by ¼ mile. If the nest area cannot be avoided, BLM will develop site-specific mitigation.
Wildlife	<p>If operations cause a water source to become unavailable to wildlife, the Authorized Officer will require a new well to be drilled, or another water development to be constructed in the general area to provide adequate water for wildlife.</p> <p>If the lease area is within a wildlife management area, the Assistant Field Manager may require additional measures, including seasonal restrictions or no surface occupancy.</p>
Wild Horses and Burros	<p>If operations cause a water source to become unavailable to wild horses, the Authorized Officer may require a new well to be drilled, or another water development to be constructed in the general area to provide adequate water for the wild horses.</p> <p>If the lease area is within a HMA, the Assistant Field Manager may require additional stipulations for the protection of wild horses and burros, including seasonal restrictions or no surface occupancy.</p>
All Resources	Operators shall adhere to all Standard Operating Procedures as outlined in this EA, unless specifically waived by the Assistant Field Manager.
Playa	Because playas are important recreational places apt to have cultural sites nearby and provide critical habitat for some migratory waterbirds and shorebirds, including Special Status Species such as the Snowy Plover, mitigation measures will be developed on a case-by-case basis. Mitigation may include, but is not limited to, no surface occupancy and seasonal restrictions.

APPENDIX H

Public Comment

This section provides a scanned version of the written comments that were received during the public review period for the Draft EA. Original letters are available for review at the Battle Mountain BLM. In accordance with the NEPA Guidelines (40 CFR 1502.19, 1503.3, 1503.4, 1506.6), and 516 DM 4.17, specific comments are addressed if they are substantive and relate to inadequacies or inaccuracies in the analysis or methodologies used; identify new impacts or recommend reasonable new alternatives or mitigation measures; or involve substantive disagreements on interpretations of significance. Comments that express personal preferences or opinions on the project are noted and do not require a response, in accordance with the above referenced guidelines.